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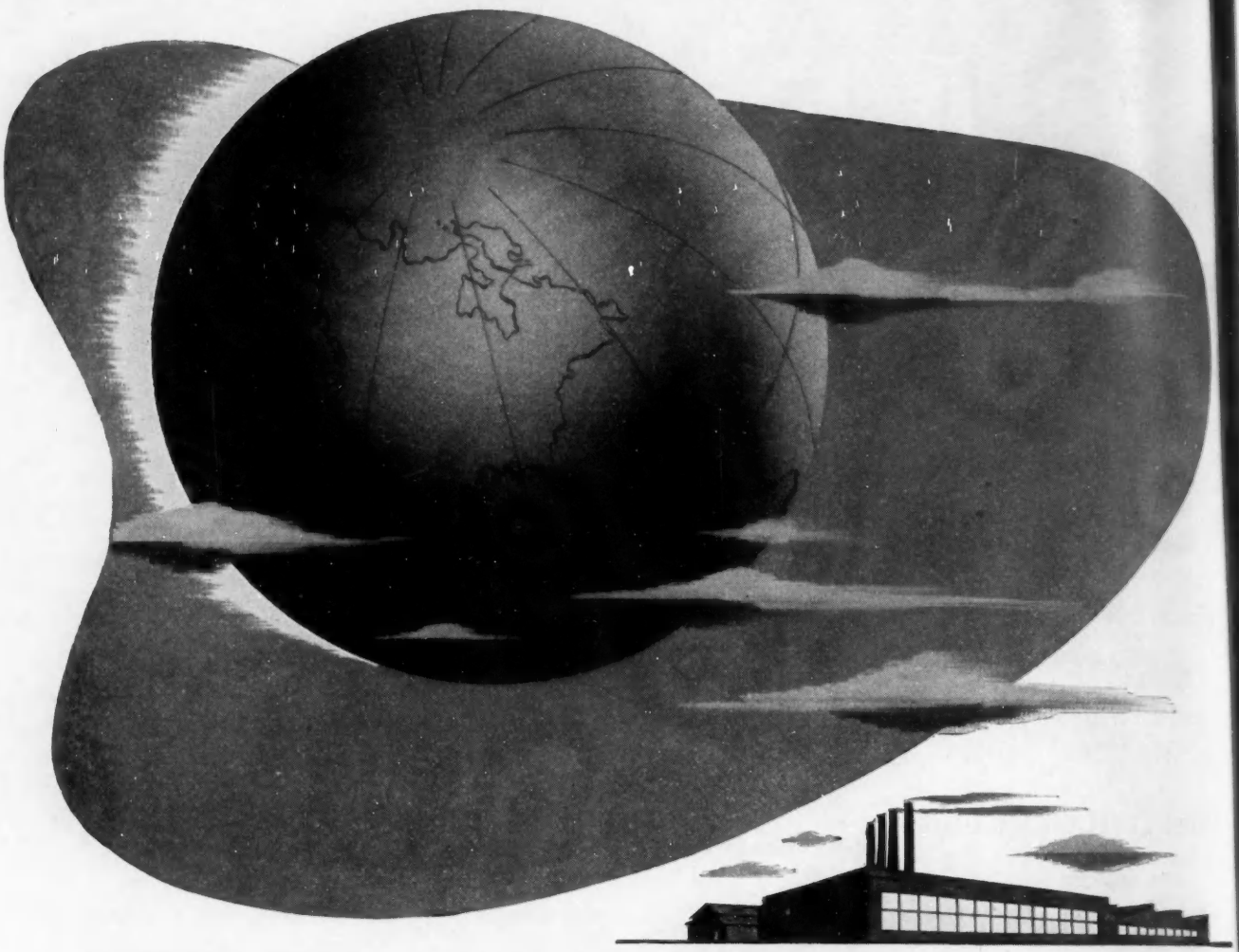

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RECLAMATION of ★

Parts Is Stressed Topic ★

At SAE National Transportation and Maintenance Meeting ★

RECLAMATION and salvage of worn parts as a vital war measure was a much-stressed topic throughout the SAE National Transportation and Maintenance Meeting at the Hotel Pennsylvania in New York, May 5 and 6.

Paced by the flat statement of Brig.-Gen. Julian S. Hatcher, chief, Field Service Division, Office of the Chief of Ordnance, that it is "necessary to examine every possibility of reclaiming old parts rather than of building entirely new ones," papers and discussions at several of the sessions expounded ways and means of doing a better reclamation job – both for military and civilian vehicles.

Field modification of ordnance vehicles, experiences with women drivers and problems of procurement of replacement parts in wartime were among the other topics dissected at this important war transport gathering. More than 500 of the country's leading transportation and maintenance men assembled for the discussions and new impetus was given to the SAE technical committee programs for meeting increasing requests for assistance from the Ordnance Department and the Office of Defense Transportation. The meeting was developed under the leadership of SAE Vice-President Austin M. Wolf and arranged under the direction of Emil P. Gohn as general chairman.

Gen. Hatcher's emphasis on parts reclamation programs came at the dinner on Wednesday evening at which the General was the featured speaker. Mr. Wolf was toastmaster, while Herbert Happersberg, SAE Metropolitan Section chairman, welcomed the members and guests to New York.

A practice blackout, starting shortly after the toastmaster had introduced the guests at the speakers' table, enhanced the dramatic effects of the speaking program, which proceeded by candlelight.

Gen. Hatcher's remarks on salvage – which included the information that at a single Ordnance depot more than $250,000 has been saved by reclamation of critical parts assemblies – came as one component of the

★

T&M Leaders Confer with General Hatcher

(Sitting, R. to L.) Brig.-Gen. Julian S. Hatcher, chief, Field Service Division, Office of the Chief of Ordnance, speaker at the T&M dinner, and Austin M. Wolf, SAE vice-president representing the Transportation and Maintenance Activity

(Standing, R. to L.) Jean Y. Ray, chairman, SAE-Ordnance Vehicle Maintenance Committee, and Donald K. Wilson, vice-chairman, SAE-OVMC

dramatic word-tour of a typical Ordnance depot which comprised a vital part of his talk, "Ordnance Field Service – Connecting Link between Producer and Soldier." (Gen. Hatcher's paper will be printed in full in the July *SAE Journal*.)

Piling fact upon fact, Gen. Hatcher told his SAE audience of the 11,000% increase in motorization from the last war to this one; explained that ordnance includes everything that shoots, that is shot, or that rolls; stated that a typical Ordnance depot covers 40 square miles, has 2000 miles of hard surfaced road, nearly as much railway line as the B & O proper, and stores 288,000 separate and complete articles, as well as 400,000 different component parts handled by Field Service.

Women are being employed as extensively as possible, Gen. Hatcher said, adding that in some positions they are definitely superior to men. Field Service now employs approximately 40% women, and the goal is to employ at least 60%, he stated.

Failure to recognize the importance of preventive maintenance may mean death to the soldier on the battlefield, Gen. Hatcher pointed out, detailing frankly specific instances – including that of a tank crew which religiously made their 100-hr check on their engine shortly before a tactical operation began, but failed to cover the air intake pipe and open air lines when they checked the engine. The sand did the rest.

"Of the 1,670,000,000 hp installed in America," Gen. Hatcher concluded, "including that within the sinews of the hay-burning horses and mules on our farms and the oil-burning locomotives on our railroads, 1,424,000,000 is in our motor vehicles. Can you wonder that we consider the Society of Automotive Engineers of the utmost importance to the war effort?"

Women Established As Truck Drivers

WOMEN drivers can no longer be considered taboo in the truck transportation business, but must be regarded as an essential group to fill the jobs of men leaving daily for war, M. A. Savin, Savin Express Co., emphasized in a paper describing a successful program of training women as heavy-truck drivers. The usefulness of the information resulting from the completion of this program is in no way depleted by the fact that union restrictions, in Mr. Savin's case, prevented use of the successfully trained women drivers on regular operating schedules.

The training program was instituted because Mr. Savin's organization was faced with the labor shortage confronting almost every business today. These trained women, like the feminine corps in the Ferry Command, were to have driven trucks only between terminals – not to have had any part in the actual handling of freight.

Starting with a class of about 22 women, who had to pass a physical examination under ruling of ICC regulations, the first step was to test their passenger-car driving ability. Those who passed were then given a small vehicle to drive, and later a tractor. Many who had succeeded so far, however, were intimidated at this point by the proportions the vehicle took on when they had to hook the tractor to the trailer. Those who were fearful were eliminated.

This preliminary instruction, Mr. Savin explained, took place in a huge field located in back of a Savin terminal, where highways, platforms and corners were laid out expressly for this purpose. The applicants were also tested in putting the trailers into place. After handling this difficult job like seasoned truck drivers, they were sufficiently experienced to drive the trailers through the streets of the local city.

Oral and Written Tests

The physical driving training was supplemented by oral and written tests on ICC regulations, as well as by a minor course in mechanics equipping the recruits to recognize engine defects. Again scoring high, the candidates were ready to go on a long-haul ride, moving from one terminal to another. They were assured of adequate rest-room, terminal and emergency assistance facilities along the way, a necessary factor to satisfy state labor laws since most of the working hours were from 10 p. m. to 6 a. m.

One woman was chosen for the job from this group, Mr. Savin said, and during the period of her employment, she was about a half hour slower than the men, but she had no accidents, and her vehicle looked cleaner than any the men had ever driven. Also, contrary to customary belief that women truck drivers must be big and muscular, this girl weighed 105 lb, and was 5 ft 4 in. tall.

Many of the applicants differed as to preference for uniform, some wearing overalls, some riding habits. All of them, however, Mr. Savin concluded, responded to the training with an interest, enthusiasm, and adaptability which bodes well for a future where women will be as established a sight driving a truck as using a sewing machine.

Brig.-Gen. Julian S. Hatcher, dinner speaker, and Lt.-Col. Harry O. Mathews, who presented a paper on "Field Modification of Ordnance Vehicles."

Women Are Efficient On Milk Route Trucks

TRAINING is all that is necessary to make a good truck driver out of a woman, and as soon as operators realize this, their manpower shortage will be greatly alleviated. This was learned by his organization, Robert Gayley, Supplee-Wills-Jones Milk Co., said in his paper on experience with women drivers on delivery trucks.

The job of driving a milk truck, Mr. Gayley continued, is the same for both men and women, except that the latter need not load or unload the truck. No distinctions are made between sexes, he emphasized, in training, standards of passing, or salary. No marked differences in ability have appeared. Instruction in the Supplee-Wills-Jones program, he said, includes the following steps:

1. Women are put through a clinical eye test by the Philadelphia police unit, which is especially concerned with testing drivers who have had accidents. This test lasts about 30 min. Althought 20-30 used to be the standard, applicants with 20-40 eyesight are being accepted, with a lower standard possible in the future. Side vision must be 60 deg, to prevent veering too much to the right or left angles. Depth perception may be 45%, a reduction from the desired 65%, which is necessary to avoid rear-end collision. The candidates also are tested for color blindness, reaction time, and resistance to glare – although, since most of the driving is now done during the day, the latter is not such an important consideration.

Errors Corrected

2. Next, the women are allowed to operate the particular vehicle they are going to drive, either an electric or gasoline truck, and they are given an 8¾-mile test through city and suburban traffic. Every point in the test is repeated often enough so latent bad habits will crop up sometime during the 8¾ miles. Halfway through the test the trainee is told of her errors, so that she may remedy them in the second half, and thus have a better chance to get a satisfactory score.

Because women drivers have become a necessity, there is no limit as to the time spent in training them, Mr. Gayley pointed out. Women under 21 yr are not eligible – and this eliminates a large percentage of applicants. Otherwise there are no restrictions.

3. The last test, which is the most difficult, is to determine what the driver knows about the truck she is to operate, and her ability to manipulate it under all conditions.

Women, as a rule, are more careful of the vehicle than men, Mr. Gayley said, due to a fear of damaging it and hurting themselves. This accounts for the fact that no trucks have been seriously damaged in accidents.

although the women themselves have suffered minor personal injuries.

The type of applicant varies from college girls to night club entertainers, all eager to get the job.

On duty, Supplee-Wills-Jones women drivers wear the white uniform of the milkman, but refuse to wear safety shoes specially designed for them.

Although there has been no dissent from the union about employment of women, Mr. Gayley stated, the taxicabs decoy trained drivers away, offering them higher salaries and easier work (no hauling milk bottles, being outdoors in all kinds of weather, and coming home dirty at the end of the day).

After the trainee is on her own, she is still not out of company jurisdiction. She is followed for a certain period, and if any mistakes occur, she is stopped on the road and reminded of them.

In case of an accident, Mr. Gayley concluded, she must go through the entire test again – without pay. This deterrent leads to much more careful driving, and those who succeed in the course know with pride that they are capable drivers.

Discussion of Savin and Gayley Papers

From a survey conducted by *Bus Transportation* on the subject of women employees, Earl Theisinger, technical editor, reported findings culled from questionnaires received from 26 city and 23 intercity bus companies. These included the following:

- Pacific Greyhound Lines is the largest employer of women in the industry and its Mare Island Navy Yard run is operated exclusively by women drivers – 400 all told, while International Railway Co. has over 100 qualified women drivers and a smaller number employed in garage service work. Most of the larger bus companies have some program for employing women.
- Married women are more responsible than unmarried ones, although a mother with young children may be a liability.
- Accidents are divided 50-50 between men and women. Women have more accidents, but of a less serious nature.
- Women 25-30 yr old, between 110-120 lb, 5 ft 4 in. tall, are the ideal bus drivers, although muscular, older ones are capable for garage work.
- Most companies find mechanics most difficult to get, and prefer newspaper advertising to U. S. Employment Service and private agencies as a means for obtaining employees.
- Companies that have taken on women drivers are more than satisfied with results, and women seem to be happy in their jobs. Many want to keep on driving after the war.

R. G. Jasper, National Safety Council, discussed some preliminary analysis made by the Council, and showed that women generally prove to be safe drivers.

Training is the key to the entire manpower situation, claimed C. Warren Stapleton, War Manpower Commission. Proper instruction, he said, will ease the scarcity of labor for the transportation industry.

A. T. Willett, Willett Motor Coach Co., asked Mr. Gayley whether most applicants were already trained when applying. Mr. Gayley replied that several were inexperienced, not even having a driver's license – and that he prefers those because they are more adaptable than the others.

Prominent at Meeting

(L. to R.) William J. Cumming, chief, Vehicle Maintenance Branch, Office of Defense Transportation, and chairman of the SAE-ODT Coordinating Committee; Emil P. Gohn, general chairman of the National T&M meeting; and Herbert Happersberg, SAE Metropolitan Section Chairman, who welcomed the members and guests at the dinner

Army Modification Woes Similar to Fleet Operators'

MODIFICATION as applied to Army vehicles is the changing of a part or parts of a vehicle to correct a deficiency or malfunction of a part, or to make an addition to a vehicle in the hands of the using troops. To this end, reported Lt.-Col. H. O. Mathews, has been established within the Maintenance Branch, Tank-Automotive Center, Detroit, a Modification Section – of which he is in charge.

Col. Mathews listed three broad types of modifications as: correction of operational difficulties which occur after equipment is put into service; improvement in production; modifications which are made to adapt a vehicle for a special job. (His paper will be printed in full in a later issue of the *SAE Journal*.)

Important things to think about when a modification is initiated, Col. Mathews continued, are the amount and kind of material needed; the type of equipment and its location; deciding whether or not the proposed program actually improves the durability, safety, and combat efficiency of the vehicle.

The Modification Section, as Col. Mathews explained it, is divided into two main units: the Preparation Unit and the Application Unit.

Preparation Unit

Collecting information for a particular Field Service Modification Work Order is the task of the Preparation Unit, which works with the Engineering Branch of the Tank-Automotive Center and shapes the work order so that it can be issued to the field. Personnel of this unit is composed of specialists on the various types of vehicles and equipment, and each project is assigned to the individual who specializes in the type of equipment the project covers.

When the needed parts are decided upon, continued Col. Mathews, a sample kit is procured and a test installation made. This test installation is very important, for frequently plans do not work out as contemplated.

"Variations of this program are very frequently necessary," he said. "In some cases, a difficulty may arise in the field which requires immediate attention. Considerable time would elapse before it would be possible for the Engineering Branch to institute changes in production. As a result, it would be impossible to procure the necessary parts from production. In these cases, it is the duty of the Modification Section to devise what is termed a 'quick-fix.' In doing this, the Engineering Branch is consulted and its advice and assistance utilized. It is then possible to go into the field at a very early date with a correction and have it applied by the time a production change has become effective."

Procurement of material, the expediting of this procurement, storing of parts, issue of parts, and their installation in the field all fall into the domain of the Application Unit.

Application Unit

As soon as it is determined exactly what parts are to be used in a modification, the Application Unit is advised what material will be necessary, together with part numbers and other needed information. They immediately request the Manufacturing Branch of the Tank-Automotive Center to initiate procurement of the necessary material through the Ordnance District supervising the plants in which it is to be produced.

A high degree of cooperation must be maintained in order successfully to procure material. A thorough knowledge of the set-up of various Army organizations is necessary to successfully distribute this material to the field and, last, a system in organiza-

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ECONOMIC ASPECTS O

THE past year has been a momentous one in our industry. The achievement of production goals set by the Government, and believed by many competent men to be almost impossible, has been accomplished by the energy, foresight, and cooperation upon a national scale of engineers and production men not only in the aircraft industry but in the many related industries upon which we are dependent for raw materials and parts. Numberless obstacles have arisen and have been overcome.

In the beginning it was recognized by leaders in industry and Government that standardization would play its vital part in making possible the realization of the national program. However, initially the form and shape which our standards efforts would take were not known. During the past year the pattern of action has become quite clearly defined, and as one problem or crisis after another has arisen, it has been met and solved by our standards engineers. In no instance that comes to mind have they failed.

This work and the many contacts with high Government officials and agencies and with representatives of many industries have broadened their viewpoint and increased their sense of responsibility. By the end of 1943, more concrete standards work will have been accomplished than would normally be done over a 10-yr period. With little doubt, the rate of progress achieved exceeds that which has occurred in any industry at any time.

The purpose of this paper is to review some of the more important accomplishments of the National Aircraft Standards Committee in 1942, this committee's methods of operation, and the cooperative relationships between it and the standards activities of the SAE. It is hoped to bring out in a concrete manner the economic importance of standards work in increasing the production of aircraft and lowering their unit cost to the Government, and to indicate the effect of standards work on the post-war production costs of aircraft. Finally, it is hoped to suggest further avenues of approach in our standards efforts that will directly assist in facilitating production and lowering not only direct but indirect costs.

At the time, it became evident that the nation's need for standardization required the utilization in our industry of the wide experience and organization of the SAE, as well as the NASC. The Government in cooperation with these two bodies and representatives of various elements in the industry wisely allocated certain specific fields of activity to the respective organizations, clearly defined their responsibilities and indicated that all standards work was to be performed through these two groups.

It was most important at this critical time that no misunderstandings arise which might affect the future cooperation of these two bodies. The situation was rather delicate because the NASC, as was natural, felt that they represented the airframe manufacturers and also the users of the raw materials and accessories employed in aircraft production. Considerable statesmanship and understanding were required on both sides. Through the proper representation of the airframe manufacturers on the various subcommittees of the SAE, the foundation was laid for the essential and effective cooperation that now exists between these two organizations.

[This paper was presented at a meeting of the Southern California Section of the SAE, Los Angeles, Calif., March 5, 1943.]

■ NASC Organization and Operation

The NASC as a national body was organized in 1941, thus bringing together the Eastern and Western Committees which, while retaining their separate identity, so coordinate their work that they function as one body. Membership is limited to airframe manufacturers, and now comprises some 25 companies, including all of the major ones. Both Eastern and Western divisions have their own chairman and elect annually a national chairman. These three men, together with a representative of the engineering managements of each division, constitute an executive committee which approves projects and policies. The NASC is affiliated with the Aeronautical Chamber of Commerce and is responsible to the Airplane Technical Committee of this body, on which are represented the chief engineers of all airframe companies. The office of the national chairman, permanently located in Washington with the Chamber, serves as a focal point for coordination.

The work of the NASC consists of a number of definite projects. These may be initiated by any interested company, which then proposes its problem in the form of a project survey to each member of the NASC, with the reasons for suggesting it, and requests their opinion of the advisability of establishing a project. Upon majority approval of the member companies, the project is brought before the executive committee, which considers the broader aspects of the work and gives final decision as to the advisability of establishing the project; and, if the decision is affirmative, decides upon the company to which it will be assigned. By this procedure, assurance is given that only important work which is of national interest is undertaken.

The bulk of the work is carried on by the individual company, which has the responsibility for the project. This company performs the necessary experimental work and studies and completes the project in its initial form. The report dealing with it is circulated to the companies comprising the division of the NASC in which the work was done. Comments and suggestions are received from each company, and these are either answered or incorporated in the report, after which it is presented for approval by the division as a whole. When such approval has been obtained, it is then sent for approval or comment to the other division. Other work of the NASC is carried on by subcommittees similar to SAE subcommittees, on which are represented several companies. These deal largely with

STANDARDIZATION

by B. C. BOULTON
Lockheed Aircraft Corp.

Executive Board of the National Aircraft Standards Committee, at a recent meeting in Washington: Standing, L. to R.: J. T. Gray, formerly manager, Technical Department, Aeronautical Chamber of Commerce of America, now with Lockheed Aircraft Corp.; J. B. Wassall, chief engineer, Vega Aircraft Corp.; E. W. Norris, secretary, and J. T. Thompson, standards coordinator, Glenn L. Martin Co. Seated, L. to R.: A. T. Waite, NASC, Western Division Chairman, Consolidated Aircraft Corp.; Eric Dudley, NASC National Chairman, Curtiss-Wright Corp., and W. D. Craig, Jr., NASC Eastern Division Chairman, Grumann Aircraft Engineering Corp.

problems relating to installations. Typical of such subcommittees are those on powerplants, electrical systems, furnishings, and heating and ventilating.

■ General NASC Work

In 1942, 30 projects were completed, and 60 projects are now in various stages of development. Formerly, essentially all the work of the NASC was concerned with specific parts furnished by vendors and directly used on airplanes as received. Early in 1942, a new form of activity started which had to do with standardization of sizes of semi-fabricated raw material, such as tubing, sheet and bar stock, extrusions, and rolled shapes. These presented such an infinite variety that the suppliers had to advise the Government agencies concerned that they could not meet the needs of industry unless drastic steps toward standardization were taken. This work paralleled and complemented the vitally important work on standardization of material specifications carried out by the SAE Material Subcommittee on which several of the airframe manufacturers were represented.

As the year passed by, an increasing proportion of the work of the NASC was devoted to this standardization of raw material sizes, and its final nature became more clearly realized. The Government agencies appreciated that the issuance by them of what would have to be more or less arbitrary standards, which did not take into account current engineering, tooling, and manufacturing situations, would result in such confusion that any benefits accruing to suppliers would be more than offset. The NASC was the one organization upon which they could call for assistance. This work required a considerable broadening of the NASC activities, both within their own companies and outside. It required standards engineers first to obtain from their own company the quantitative facts in regard to specific usages, and a pretty clear idea of the difficulties involved in engineering, tooling, and manufacturing. As the number of available sizes of various materials was curtailed, the task of securing and compiling this volume of information was rather herculean in proportions.

Aluminum alloy tubing and sheet – The first of these projects concerned itself with aluminum alloy tubing in its various alloys and tempers. Responsibility for the coordination of this work was carried by North American. Last May, the Working Committee of the Aeronautical Board issued a list of sizes which had been cut down from over 1500 to a total of 140. Contrary to previous understanding, this list, instead of applying only to new design, was made applicable to production. Immediately it became evident that if it were rigidly enforced all aircraft production would be most seriously affected. As a result, the Aircraft Scheduling Unit was forced to grant specific monthly permission to different companies for the procurement of materials necessary to continue production.

During the summer, the NASC collected additional data, and as a result of further meetings with the Aeronautical Board, at which NASC was adequately represented, as well as aluminum tubing producers, a revised

list (AND sheets 10105-10108) was issued comprising a total of 295 sizes, in five alloys. Since then the number of requests for special allocations has been greatly reduced and opportunity given to airframe manufacturers to modify their engineering and tooling to accommodate the new tubing standards.

Inquiry by the WPB on the effect, during the last few months of 1942, of this standardization indicated that it had resulted in an increase in production of at least 10%, and as additional special sizes or non-standard sizes are eliminated it is anticipated that this program will result in stepping up production of aluminum alloy tubing by a total of 15%.

Two additional projects of the same nature concerned with aluminum alloys were undertaken and carried through by North American. These had to do with the standardization of bar, rod, and wire, and are now reflected in AND sheets 10125, 10126, 10130, 10131, 10132. The final project was concerned with the standardization of sheet and strip sizes, and the work was concluded by the issuance of AND sheets 10115-10120 inclusive. The standardization of sheet and strip, particularly as to length and width, has probably improved production even more than in the case of tubing. It has made it possible for production of sheet and strip to be made largely a continuous semi-automatic process with a minimum of labor.

Steel bar, tubing, and sheet – Similar projects were set up on steel products, and the responsibility assigned to the Buffalo plant of Curtiss-Wright. Standard sizes for steel bars, rod, and wire were established, as well as for sheet and strip. The new restricted tubing standards are given on AND sheets 10102 and 10104. The situation with regard to steel stocks was not as serious as in the case of the aluminum alloy products due to the smaller usage, particularly of tubing. The AN standards issued included 323 sizes, whereas the NASC recommendations totaled only 150.

Aluminum alloy extrusions and rolled shapes – What is probably the most critical production situation of all developed during the latter part of 1942 and has now reached an extremely critical stage. This is the acute shortage of extrusion capacity. Despite the completion by the Martin Company of one of the important projects of the year on the standardization of extrusions, the necessity for radical action to reduce the volume of extrusions in the face of the rapidly rising aircraft production became painfully evident.

Fortunately, the facilities for rolling sections from aluminum alloy strip stock are ample to permit the substitution of rolled for extruded sections. However, in order to avoid difficulties of a serious nature, it is necessary to make a most careful and detailed study of the problem. Unless rolled sections to be substituted for extruded ones are interchangeable both dimensionally and structurally, innumerable production tools require modification or the structural safety of the airplanes is impaired.

The NASC standards engineers again cooperated by determining the quantitative usage of all extrusions and, in cooperation with their respective engineering and tooling departments, investigated with the greatest care the possibilities of substitution. The Boeing Aircraft Co. performed a notable service by issuing to the industry a catalog listing on the same page extruded sections and the equivalent rolled sections with their properties. At a special meeting of the NASC in January, with representatives of the Government, 163 rolled sections suitable for the conversion program were available, and in the recent February meeting in New York with representatives of the Government and the producers of rolled sections, data relating to 347 rolled sections were made available.

Rapid progress is being made in this program of conversion, which is the most serious that has been so far faced by our industry; and it is anticipated that within two or three months the requirements per airplane for extrusions will be decreased approximately 30% by weight and 50-60% by footage. The latter is considered to be of more importance than the former because the bottleneck lies in the production of enormous quantities of relatively small sections which require heat-treating and processing. It is felt that such a program would not have been possible except for the facilities afforded by the NASC for cooperation and coordination between airframe manufacturers, raw material producers, and the Government.

Close-tolerance bolts – It is somewhat difficult to select for special comment a few of the numerous standardization projects completed by the NASC. In the writer's opinion, five of these are especially noteworthy. One was a project for the standardization of close-tolerance bolts, assigned to North American. Hitherto, such bolts, needed where shock or reversible loads are to be carried, have been special, and hence produced at high cost. In carrying out the standardization work, it was decided that the close-tolerance bolts should be interchangeable with existing AN bolts, except for diameter tolerance. Limits before and after plating, the length of thread, the ratio of maximum length to diameter, and the straightness requirements were also considered, together with numerous other factors such as identification to prevent confusion with AN bolts, and considerations of manufacture and inspection.

This project, after acceptance by all companies and the WCAB, was concluded with the issuance of NAS sheets 53 to 66 inclusive. As an example of the cost savings involved, the Lockheed Aircraft Corp. was using 4500 of certain special bolts per year at a cost of 52¢ each. The cost of the comparable NAS bolt is 28¢, a reduction of 46%.

Internal wrenching bolts – Assigned also to North American Aviation, Inc., was a project for the standardization of internal wrenching bolts. Numerous applications for this type of bolt had developed for outer wing attachments, and other similar points of high-tension stress concentration in the modern airplane. Commercially available bolts of this type did not as a rule meet the physical requirements, as they were intended for other purposes. It was decided in the standardization work to make these bolts as nearly interchangeable as possible with the corresponding AN hex-head series. Therefore, all dimensions relating to the shank and threads were kept the same. Because of the nature of the application of these bolts, a high heat-treatment of 160,000-180,000 psi, with a minimum elongation of 12%, was specified. As was the case with the close-tolerance bolts, the desired physical characteristics were given but not the material, thereby allowing a choice of the material that would be least critical.

Many meetings and much protracted discussion were required before agreements were reached, satisfactory both to all aircraft manufacturers and bolt vendors. Finally, the standards were approved by all NASC members and

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Engineers Face New Plan Of Scheduled Components

PRODUCTION engineers will be called upon to operate under the new Components Scheduling Plan (CSP) designed to schedule component production, after June 1.

1. The Components Scheduling Plan establishes procedures for limiting major claimant agency production programs on the basis of WPB Industry Division determinations of available production capacity, and

2. The Controlled Materials Plan (CMP) will continue to govern materials flow.

CSP contemplates elimination of CMP authorized production schedules for components as actual production schedules, however.

Component scheduling is the major device upon which WPB will now depend to eliminate production bottlenecks. The plan will *not* be confined to *critical common components* as is the scheduling procedure under M-293, but will cut across broad segments of industry.

CSP is an attempt to regulate industry without resort to legal regulations, its proponents in WPB say.

It requires claimant agencies to report to Industry Divisions of WPB total *control* component requirements at the time major programs are planned. But the claimant agency is permitted to determine whether it, the prime contractor, or the control component manufacturer has the necessary technical information to make the report which is required on Form PD-903, the device to implement the plan.

Purpose of CSP

The plan is designed to give each manufacturer in the contracting chain the relationship in time and quantity between the requirements for components placed upon him and the program into which those components are to go.

The plan is based upon the fact that there are certain principal components around which limitation of an entire production program may revolve. CSP proposes through its scheduling procedures to establish controls over these key components, thereby establishing production controls over the entire war production program.

Claimant agencies to be included under the plan on June 1 are: Army, Navy, Maritime, Aircraft Scheduling Unit, Rubber Director, Lend-Lease, BEW, Petroleum Administration, Office of War Utilities, and the Canadian Division of WPB.

Major problems involved on that date will be:

Tanks;

Combat vehicles;

Motor transport vehicles, as programmed by the War Department;

Ships (all sizes and types);

Power generating plants, both public and private, as programmed by the Office of War Utilities, and

Plants designed for the production of rubber, high-octane gasoline, aluminum, magnesium, and steel.

On June 1, control components will be: **Internal combustion engines, boilers, compressors, dry vacuum pumps, turbo**

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Billions Saved In Renegotiation

MORE than $2½ billion has been saved to the taxpayers of the nation through renegotiation, Secretary of War Henry Stimson announced recently, as he praised the cooperative spirit of American industrialists. The Army's Price Adjustment Board was formed a little over seven months ago.

Nearly 6000 companies have been assigned by the War Department for renegotiation of contracts to date.

Highlights of the report:

At the time of letting most contracts, neither the manufacturer nor the Government procurement agency knew what a fair profit would be.

More and more companies are coming to the Board asking for renegotiation study, to determine their respective year-end or fiscal-year financial position.

Comment by Mr. Stimson:

"Our experience is that the contractors of the nation have been more than willing to assist in renegotiation.

Navy Plane Contract Renegotiation Under Way

Nearly a billion dollars have been saved to the Navy through airplane and parts contract negotiations to date, Under-Secretary James Forrestal told the Senate.

Breakdown:

Refunds	$253 million
Price reductions	531 million
Voluntary reductions	150 million
Total	$934 million

Mass production methods, demanded by the unprecedented volume of Army and Navy plane orders, had resulted in numerous manufacturing economies.

One aircraft company did a total of $6 million in 1939, and delivered nearly $400 million to the Army and Navy in 1942.

Another company, with an original investment of $8 million, would have had a $27 million profit after taxes, he said.

SWPC

Little Business Agency Achieves Near Autonomy

Chairman Robert W. Johnson of the Smaller War Plants Corp. has been authorized by WPB Chairman Donald M. Nelson to set up necessary organization and undertake complete administration of its work "notwithstanding any WPB orders or instructions to the contrary."

Thus SWPC, long a step-child in the OPM and WPB families, has almost complete autonomy – similar to that of the Office of Rubber Director.

Col. Johnson remains a vice-chairman of WPB, and heads its Smaller War Plants Division. Mr. Nelson retains the right to appoint SWPC directors, as provided by the Smaller War Plants Act, and to supervise policy.

Congress has been restive about SWPC, believing that its close association with the WPB has hampered its work.

Conservation Tasks Of WPB Realigned

Howard Coonley, one of America's leading authorities on industrial standardization and simplification, has reorganized his Conservation Division into two primary branches:

Materials Branch, under C. L. Warwick, erstwhile secretary of the American Society for Testing Materials. This unit will continue the work of substitution and specifications.

Product Branch headed by R. B. Shephard. This unit will carry on the work of

simplification, which formerly was under Mr. Shephard.

Harvey A. Anderson, a veteran in conservation work of WPB, becomes deputy director of the Conservation Division.

Ninety-six trained conservation consultants of the Division remain. Many of these are field men, 64 of whom are trained technicians in various fields, with an average of 20 years experience.

Part of the program is expected to stem from the new Office of Civilian Requirements (see "Civilians" below).

Civilians

Wide Power Given To Whiteside, New Chief

JUST when it appeared that Charles E. Wilson had been assigned WPB's major operating functions (see "WPB's Wilson, etc.," p. 41) Chairman Donald M. Nelson began to cloak Arthur D. Whiteside, a new vice-chairman of WPB, with unprecedented authorities.

A veteran of the National Defense Advisory Commission, Office of Production Management, and WPB, Mr. Whiteside has returned to Washington as head of the new Office of Civilian Requirements, succeeding Joseph Weiner.

Added to every power of his predecessor, Mr. Whiteside:

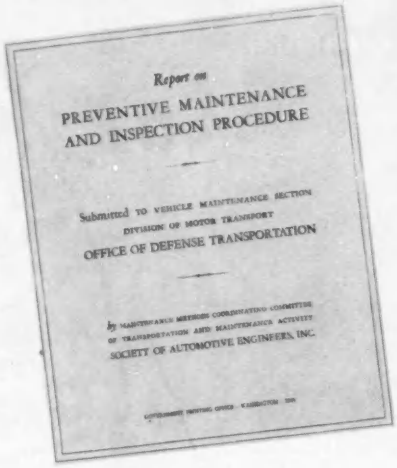
- Takes over authority for civilian distribution of:

  Petroleum from Coordinator Ickes, and Rubber from Director Jeffers;
- Will control the production and distribution of consumer goods, although he will have nothing to do with the machinery for such manufacture;
- Assumes jurisdiction over repair parts for automobiles, and all other civilian supplies. Under his predecessor's operation, the civilian requirements amounted to materials that none of the other claimant agencies wanted;
- Represents Mr. Nelson in contacts with the Office of Price Administration;
- Will be responsible for initiating simplification and standardization of consumer goods;
- Determines the impact on manpower shortages as related to manufacture and distribution of consumer goods;
- Serves as a member of the Requirements Committee, which J. A. Krug, WPB Program Vice-Chairman heads;
- Serves as member of all industry requirements committees;
- Becomes vice-chairman, under Mr. Nelson, of a WPB Policy coordinating committee.

The reason for this wide delegation of power is to convince Congress that WPB intends to look out for the needs of civilians at all costs, and thus ward off rumored legislation for an independent agency outside of WPB.

The Maloney bill, to create a separate civilian supply agency, has stimulated the Pepper-Kilgore-Tolan cohorts to merge this with their czar-of-czars proposals. If the minorities in both houses agree to fight it through without horse swapping, bets indicate that WPB and WPBers will be in for a hard battle. This type of alignment deposed Leon Henderson, and might undermine Donald M. Nelson and his men.

U. S. Issues Fourth SAE-ODT Manual



"Preventive Maintenance and Inspection Procedure," prepared by a special committee of the Society at the request of the Office of Defense Transportation and approved by the SAE-ODT Coordinating Committee, is the fourth report to be published by the Government Printing Office and issued by ODT.

Members of the committee which prepared this report are:

E. N. Hatch, chairman, American Brakeblok Division; W. H. Bean, Surface Transportation Corp.; W. K. Bennett, White Motor Co.; E. C. Blackman, Socony-Vacuum Oil Co., Inc.; R. J. Collins, Kansas City Power & Light Co.; B. D. Connor, Boston Consolidated Gas Co.; A. L. Farnsworth, Kings County Buick, Inc.; Floyd Gardner, Los Angeles City Schools; G. N. Gascoigne, The National Refining Co.; L. J. Heinrich, The Autocar Sales & Service Co., Inc.; E. W. Jahn, Consolidated Gas, Electric Light & Power Co.; G. W. Johnson, Bowman Dairy Co.; S. G. Page, Equitable Auto Co.; E. C. Paige, The Ethyl Corp.; W. G. Perriquey, Faber Laboratories, Inc.; J. J. Powelson, Standard Oil Co. of N. J.; S. B. Shaw, Pacific Gas & Electric Co.; Hoy Stevens, The Cleveland, Columbus & Cincinnati Highway, Inc.; and O. W. Teckemeyer, Procurement Division, U. S. Treasury Department. M. E. Nuttila, Cities Service Oil Co., is the project chairman

Half-Million In National Roster

More than 500,000 engineers, scientists, and other specialists of the nation have been listed by the National Roster of Scientific & Specialized Personnel.

The National Roster is administered by Dr. Leonard Carmichael, president of Tufts College.

To date more than 140,000 names have been certified to various war agencies requiring the full-time or advisory services of engineers and other specialists in the war effort. The task of collecting the names and pertinent data was begun in June, 1940.

Aero Plants 10:1

Federal Outlay Totals $2½ Billion

MORE than $2½ billion has been invested by the Government's Defense Plant Corp. in aircraft and aircraft accessories factories. Jesse Jones, Secretary of Commerce, in making this announcement said: "This exceeds by about ten times the entire assets of all aircraft manufacturers before the war."

Breakdown:		
Aircraft	$483,483,000	51 plants
Engines & Parts	1,965,351,000	344 plants
Additions	208,278,000	401 plants
Total	$2,657,112,000	

Clay to Planes

Bureau of Mines-WPB Plan Seeks Aluminum Sources

FEDERAL geologists are geared for the most intensive search for domestic aluminum resources ever undertaken by the nation. For years the Bureau of Mines of the Department of the Interior has been prospecting. The Bureau technologists have hit the trail.

WPB and the Bureau have obtained a $500,000 appropriation from Congress to expand and intensify the search for bauxite, alunite, and aluminous clays.

- Although there has been a 10-fold increase in the use of domestic bauxite during the past two years, the known reserves are not enough to make the United States self-sufficient.
- Second-rate bauxite, alunite, and alumina clays must be resorted to if the nation is to have sufficient domestic supplies for building war planes.
- Seven laboratories and pilot plants are working around the clock.
- Although there are known deposits of these raw materials in many states, intensive work is under way in Missouri, Alabama, Utah, Nevada, Maryland, Tennessee, Washington, Oregon, and California. The new program may make Arkansas the "No. 1 bauxite state," Dr. R. R. Sayers, director of the Bureau of Mines, told the Congressional committee.

As the field, laboratory, and pilot plan work progresses, WPB will be called upon to authorize the construction of full-scale commercial plants.

Antifreeze Appeal Withdrawn from WPB

Members of an SAE War Engineering Board committee, upon whose report the War Production Board issued an order on Jan. 20 forbidding the manufacture and sale of deleterious antifreezes, went to Washington to testify in behalf of the Government in an appeal case brought by a manufacturer.

Against this array of engineering talent the manufacturer of a CaCl solution withdrew the appeal, but testimony of the SAE members was taken in case a similar appeal is sought.

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Reclamation of Parts is Stressed Topic At SAE National Transportation and Maintenance Meeting

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tion is necessary to be sure the program is carried out.

Discussion of Mathews Paper

Transportation and maintenance operators unanimously agreed that the Army has the same kind of vehicle headaches with which the fleet operators have been contending for years. And the Army's method of solving these problems is not unlike the systems used by their individual companies. The Modification Section is to be complimented for its work in view of the fact that the Army's vehicle modification program is of such vast magnitude, agreed L. R. Gwyn, Jr., Railway Express Agency; Gavin W. Laurie, Atlantic Refining Co.; John M. Orr, Equitable Auto Co.; Stephen Johnson, Jr., Bendix-Westinghouse Automotive Air Brake Co.; F. K. Glynn, American Telephone & Telegraph Co.; Emil P. Gohn, Atlantic Refining Co., and others.

"To hear Col. Mathews talk about needing a part and going out and *getting* just what you want sounds like seventh heaven to today's fleet operator," confessed Mr. Laurie.

Mr. Gwyn suggested that there should be some method of check-off sheets to permit the Modification Section to know what has been done or what is still undone. W. D. Bixby, United Parcel Service, agreed that the only way to be assured that each unit has been serviced is to identify it by serial number. Col. Mathews answered that there just wouldn't be enough room to house data referring to individual serial numbers, nor time to check off each vehicle. Actually, a deadline is set – and as it nears, announcements are issued. This usually brings in the list of last batch of vehicles still unchanged.

"The first time a failure is reported, we don't pay too much attention to it, but the second time the same failure occurs, we take immediate steps," said Mr. Laurie, referring to practice in the Atlantic Refining fleet. When our test engineer finds out what the trouble is, whether it be in 10 or 200 trucks, the campaign change is made throughout the group because experience has taught that once a failure occurs it will generally have to be taken care of sooner or later.

"I'm glad Col. Mathews emphasized the fact that one must make sure certain changes are absolutely required, because when something new develops, fleet operators have a tendency to junk all of the old equipment," declared T. C. Smith, American Telephone & Telegraph Co.

Col. W. B. Johnson, Aberdeen Proving Ground, brought out that modification programs are "sold" widely through *Army Motors* and other service publications, thus supplementing effectively the regular routine.

Right kind of personnel is hard to get, admitted Stephen Johnson, Jr. When the Army needs men, they can whisper to the draft board, but the fleet operator is up against it.

Don't let's get the idea that all Uncle Sam has to do is work on the draft board for personnel – the *right* kind – reminded William E. Conway, Studebaker Corp. Much of the Army's personnel is in need of training, too, he said.

Speaking from the manufacturer's point of view, O. M. Brede, General Motors Truck & Coach Division, said that no matter how well equipment is designed or built, service will bring unexpected difficulties. The manufacturer tries to move quickly and do his share in the change-over plans, he said, but is often hindered by the difficulty of getting material promptly and in large quantities through the Controlled Materials Plan.

Proving grounds and modifications departments interlock and should strike a balance, pointed out M. E. Nuttila, Cities Service Oil Co. Where the proving ground is small the modifications, of necessity, must be larger. Col. Mathews remarked that many things show up in proving ground tests, but usually the model is already in production. Some vehicles are caught and the changes made, he said, but the balance has to be changed somewhere further along the line.

Col. Mathews reported that cold starting tests made last winter on all kinds of equipment developed much data on what can be done for winterization. Tests were made in temperatures as low as —75 F. Engine oils and gear lubricants are absolutely solid at this temperature. Some manufacturers can keep a battery going at —40 F for 17 hr by properly designing the case and using a coolant.

In answer to Mr. Gwyn's question as to whether or not crankcase ventilation is an answer to the sludge problem, Col. Mathews said that unless head gaskets are tight, water is bound to get in, and that the tightening up of cylinder head gaskets – while not a sure cure – is certainly an improvement.

'Cold Weld' Repairs Save Cracked Heads

WITH particular emphasis on repair rather than replacement, mechanical lacing or cold welding is recognized as a process that has made it possible to accomplish results without the use of heat or fusing, explained A. B. Tincher, Kerkling & Co., and this method has been accepted as a practical, permanent and inexpensive means of salvaging cracked cylinder blocks in the automotive industry.

The system is so simple that it can be understood and used by the average garage mechanic, but because of the secrecy on the part of individuals and companies who hold patents to their methods, general knowledge of cold welding has been previously retarded, reported the speaker. However, its growth has been rapid in the past few years.

The method which Mr. Tincher described consists of a mechanical lacing process using taps, dies, drills and metal rod.

Slides were shown which showed a step-by-step repair on a cracked valve seat in a V-8 motor. After the valve seat has been removed the progress of the crack is stopped by drilling a hole at the lower end of the crack in the valve port, and the same procedure is followed in the cylinder. Next, holes are tapped and threaded pins inserted. Parallel slots are sawed on either side of the crack and a slight under-cut is made to give a dovetail effect. With a cape chisel the metal between saw marks is removed to form a channel. Holes are again drilled and tapped, and pins dipped in metallic seal are inserted. The surplus is cut off, leaving about 3/16 in. to allow for peening and finishing. When the peening job is complete, the job is finished by grinding off surplus metal with rotary file and polished smooth with rotary stone, if desired.

A demonstration preceded the meeting.

Activity Committee Meets

THE SAE Transportation and Maintenance Activity Committee met on the evening before the opening of the sessions. Progress of T&M committee work for the Office of Defense Transportation and for the Field Service Branch of the Office of the Chief of Ordnance was reviewed, measures for further expediting these programs were considered, and plans for future T&M meetings were discussed.

Two members of the Transportation and Maintenance Activity Committee whose names were omitted from the roster as published earlier this year, Vice-President Austin M. Wolf has announced, are William J. Cumming, Office of Defense Transportation, and F. K. Glynn, American Telephone & Telegraph Co.

Metal Spray Finding Place in Conservation

IN his paper, "Fleet Experience with Metal Spray," H. I. Sullivan, Eastern Massachusetts Street Railway Co., said that the necessary equipment in metal spraying is a portable metallizing gun which weighs only five lb, and has two parts – the gas head and nozzle, and the mechanism for feeding the wire to be sprayed.

Three hoses bring acetylene gas, oxygen and compressed air to the unit. A main control valve regulates all three. The acetylene and oxygen are metered and mixed, and emerge from the gun in a cone of fuel

which surrounds the metal wire. The air is delivered as a cone shaped blast surrounding the combustion cone, and a portion of the air drives a small air turbine. Through reduction gears, the turbine drives milled feed rolls. These pull the wire into the gun and push it into the melting zone, which is maintained at a temperature of 4000 to 6000 F by the burning gases.

As each drop of molten metal is formed, the air blast atomizes it, and drives it into the base metal at velocities of from 500 to 800 ft per sec. Less than 0.001 sec is required for melting and deposit, and cooling is almost as rapid.

In preparation of the surface for metal spraying, he said, they have found that the rougher the surface, the better the bond will be between the sprayed metal and the part.

"We have found it impossible to metallize the interior surfaces of small diameter circular parts. Failures have resulted in each instance."

Tensile strength of sprayed metal is quite low, but compressive strength is high. Therefore, sprayed metal should be applied *only* where compressive stresses exist, and not where tensile or torsional stresses must be encountered, cautioned Mr. Sullivan. Also, he continued, sprayed metal is quite brittle, so it is unsuitable for parts which may be bent after spraying.

Metallizing is still in the process of evolution, he reported, with some applications still in the experimental stage.

Discussion of Tincher and Sullivan Papers

In using the cold welding process, explained Mr. Sullivan, the purpose is for restoration, and the material which is left in the original part must have sufficient strength to withstand torsional and tension stresses. Spraying metal on the part adds only to the compression strength.

It was emphasized in discussion from the floor that the success of spraying depends entirely upon the preparation of the part to be sprayed. Where unit pressures are high, a really good mechanical bond is essential to prevent failure.

H. M. Atwood, Metallizing Co. of America, reported that his company has just gotten out a fuse bond process which is available for sale at $350 for the complete unit.

Success of the "Metal Lock Process" was questioned by Philip Ruskin, Diesel Publications, Inc. This system seems to be shrouded in mystery and he wondered if it was a military secret. Mr. Tincher explained that it is known as the Harmon process. It is more or less a lacing process, and it has been used quite a lot in the West although it is not generally popular. Royalties are charged on this process, he said.

No trouble has come up with repairs made using the K&W cold welding system, reported H. B. Truslow, Richmond Auto Parts, in discussing his company's experience. The only complaints, he said, were in connection with cracks which did not show up easily and thus slipped by unfixed. His company believes that you can do a lot better work if you have variable speed drills and they have found that a small ¼ in. pneumatic unit covers almost all types of work.

H. Willett, Jr., The Willett Co., asked whether any cold welding process had been used in repairing petroleum hauling tanks. Mr. Tincher had no experience with work on tanks – just on motors – but John E. Wakefield, Metallizing Engineering Co., Inc., feels that this type of work will be successful it you can open the crack enough to get metal in.

Spraying zinc to prevent corrosion is one of the commonest methods used in corrosion repairs, reported Mr. Atwood. It was originated in Europe in 1898. The life expectancy for a steel structure sprayed with zinc is limited only by the thickness of zinc which is applied and the strength of the bond.

C. M. Billings, Gulf Oil Corp., asked if there is any advantage in spraying pure aluminum on a member as compared to zinc to prevent salt spray corrosion.

In salt spray corrosion, answered Mr. Atwood, zinc has a tendency to deposit a denser coating than does aluminum. But where there is heat to be considered, aluminum is superior to zinc. However, there is no question as to which is used now since zinc can be gotten with a fairly low priority, but aluminum cannot be obtained unless the end use is for aircraft.

'Conservation' Is Key To Continued Operation

WARTIME shortages are making "conservation" the watchword of the average citizen as well as of the operator of large fleets of motor trucks, Robert Cass, White Motor Co., told the closing session. Since the fleet operator has always practiced a certain amount of conservation, he is apt to feel that he is already doing about all he can to protect the machines under his control.

In his paper on "Wartime Replacement Parts," Mr. Cass showed why it is necessary for the truck operator to reappraise his situation, not overlooking any possible method whereby parts can be made to last longer. He also suggested a program for carrying out this fundamental purpose of taking care of what we have.

During the past year, trucks were being replaced at a rate of only about 1% of the total number of service – compared to the usual figure of about 10%, he continued. Trucks are being worked much harder than usual – heavier loads and longer hours have become the routine procedure. The ranks of trained drivers and maintenance men are being depleted. In addition, the parts situation is becoming critical at a time when more parts are being required for adequate maintenance. Parts are wearing out faster than normal because they are being made of substitutes that are often less satisfactory than those previously used, and because the engineer frequently is making substitutions of materials for which he has insufficient operating data to guide him.

All of these factors would seem to indicate that the situation is pretty hopeless. However, that is not so, Mr. Cass maintained. Serious as the situation is, he believes we are still much better off in the overall picture than are other warring countries.

The lesson that must be learned is that the fleet operator must go to the limit in preventive maintenance. To carrying out a program, Mr. Cass suggested:

1. Watch particularly all parts being used that include less-satisfactory substitutes.

2. Study overloading to see if it can be eliminated entirely. A small per cent of overload decreases the life of parts by a much higher per cent. On the other hand, a slight underload pays good dividends in a higher per cent increased life expectancy. In these days of materials shortages, this matter should be given the most careful consideration, as the temptation is to overload more rather than less. The rule should be recommended engineering ratings may be exceeded only under unusual conditions.

3. Cut down engine speeds. Rearrange schedules so that engine speed can be held at least 10% lower than at present.

4. Educate each driver to his part in the conservation program. Even though a driver has a perfect safety record, his method of operation may be wearing out parts much more rapidly than necessary. He should be taught to make it a habit to warm up his engine slowly; to keep a careful check on engine temperature so that it is held at normal; to keep the engine speed at the minimum possible; and to accelerate at a reasonable rate. Such precautions may increase the life of pistons, cylinders, and bearings as much as 20% – and they are all within the control of the driver.

As the present equipment gets older and older, it is essential that there be no let-up in the practice of this preventive maintenance – rather it will be necessary to buckle down and practice it more faithfully than ever.

"It is a real challenge both to the operator and the manufacturer," Mr. Cass concluded, "to build and develop organizations, buildings, and methods that will make certain every motor truck that is running today will be kept running for the duration and will be maintained at a standard of efficiency that will decrease the rate of wear on replacement parts just as much as possible. Finally, perhaps we should realize that the same strategy and resourcefulness that is necessary on the war front is equally vital on our truck front."

Discussion of Cass Paper

Before opening the meeting to general discussion, Chairman Page called on W. J. Cumming, chief, Vehicle Maintenance Section, Office of Defense Transportation, Division of Motor Transport, for the story of how ODT fits into the truck picture.

Mr. Cumming explained that with the advent of the new Controlled Materials Plan, or CMP, ODT has become a claimant agency, gathering evidence as to why the various critical materials are needed, and transmitting this information to WPB to help the latter determine who should be provided with material and how much of it.

Mr. Cumming's ODT Vehicle Maintenance Section is setting up two programs of interest to the truck industry. One of these is to build up a pool of new trucks. Mr. Cumming explained that it seemed better to keep their requirements within reason, and to have a small pool and keep the equipment flowing. If the pool becomes too large, the armed forces will step in and take the machines, and it is hard on the manufacturers whose equipment is frozen for too long a time. He added that ODT is trying to plan ahead in its program for about 18 months. So far, it has been fairly successful in building up the pool with light and medium-duty trucks, but heavy-duty trucks seem to be almost non-existent.

Mr. Cumming also touched on the very critical replacement-parts situation. He expressed the hope that by next July or August, the picture will look much better than it has been to date.

The new valves mentioned by Mr. Cass

interested W. A. Taussig, Burlington Transportation Co., who wondered how they could be recognized and how much clearance would be required with them. He also felt that the tendency these days was to increase rather than decrease the interval between repair periods.

Mr. Taussig then mentioned one experimental use of synthetic tubes by his company that was turning out very successfully. The tubes are being used to carry diesel fuel from the fuel filter to the injection pump on several buses. One of them has been running for five months and giving no trouble.

In reply to Mr. Taussig, Mr. Cass explained that the new valves can be recognized because they are made of two pieces welded together, and when installed using the old clearances, they will make more noise. The amount of clearance necessary for them will have to be determined by hit-and-miss methods. Mr. Cass suggested as a rough guide that the clearance would have to be cut down about 0.002 in.

The author agreed with Mr. Taussig about using less maintenance in some cases – especially for short-haul operation. He explained that he was referring to over-the-road truck operation, where there is no control over the truck or the driver. In such cases it is important not to take any chances with failures, as a breakdown when the truck is far from its home garage is quite serious.

From Fred L. Faulkner, Armour & Co., came the wish that the thermostat and the clutch-facing shortages be alleviated. He said that it is almost impossible to get thermostats – very important items in the protection of engines – and that the new clutch facings are hard and roughen very quickly.

He questioned the need for many new trucks. He feels that the big lack is in replacement parts, and that the truck industry should stick together on this problem instead of wasting time trying to get new equipment. The war has shown us, he said, the indispensableness of the motor vehicle. However, this fact is not sufficiently recognized. Thus the truck industry is without priority assistance – and many of the parts that the operators are crying for are small and cheap, but they *are* essential to keep the trucks running.

The driver problem did not seem as serious to W. E. Conway, Studebaker Corp., as it did to Mr. Cass. Mr. Conway believes that the solution to most of the problems is to train new drivers. The trouble has been trying to teach old drivers, who thought they knew all about driving, things that they didn't know.

L. G. Kurtz, New York City Department of Public Works, thought that the driver was the key man in the whole picture. He is the one who causes the damage through lack of interest and lack of knowledge. Mr. Kurtz said that the City of New York is setting up training programs – one for mechanics and one for drivers. And trying to train 12,000 good drivers is no small task, he emphasized. The first job has been to train 150 instructors. They are still working on this.

The failure of Mr. Cass to mention lubrication was filled in by E. P. Gohn, Atlantic Refining Co., who stressed the point that lubrication is one of the first principles of preventive maintenance – particularly lubrication of the chassis.

Stephen Johnson, Jr., Bendix-Westinghouse Automotive Air Brake Co., corroborated Mr. Cass in his statement that domestic iron is proving more successful in the production of steel springs than the now unavailable Swedish iron. Lead-babbitt bearings are also giving a good account of themselves when the temperatures are kept down.

In regard to the rubber problem, Mr. Johnson told about reducing the weight of pure rubber in a brake diaphragm by 23% to get an improved part. But the change to synthetic tubing has not been as successful – the synthetic requires a flared fitting and it is impossible to tighten the connection in very cold weather without cracking the end of the tubing, Mr. Johnson said.

The change from copper to steel tubing for brake lines has proved satisfactory in the case of trailers, according to Mr. Johnson, because the lines are relatively free from bends, as compared with trucks. There is nothing wrong with steel tubing, he emphasized, when it is properly treated. The change from brass to steel fittings is not a problem of design but of machining. It takes about three times as long to machine a steel fitting on an automatic screw machine as to machine the same part in brass.

J. V. Bassett, Manhattan Rubber Mfg. Division, explained that the troubles from the new fan belts were generally caused by improper installation. The belts should be installed reasonably tight, then the motor should be run for 10 min. after which the belt should be given a final tightening.

Woven clutch facings are so critical, Mr. Bassett explained in answer to those having trouble with the new material, because there simply are not enough looms to weave the cloth from which they are made.

After the members of the audience had finished their discussion, Mr. Cass again took the floor to clear up several points that had been raised. If the present clutch facings are unsatisfactory, the operators themselves **must** be the ones to go to Washington and prove that using poor ones is bad business. No one will listen to the engineers if they try to do it. It must be the men who use them.

Mr. Cass thought that the use of hard facing on valves, as mentioned by Mr. Kurtz, was worth while if the work was done by somebody having plenty of experience with the process. Just to have a hard face is not sufficient: it must be put on with the correct technique.

Carbon wire cannot be used, as one member suggested, because it rusts easily, and stainless steel wire is unsatisfactory because it cannot be drawn finely enough and the wire won't grip. Copper wire must be used, as there seems to be no satisfactory substitute.

SAE Coming Events

June 2-3	**SAE Diesel Engine and Fuels and Lubricants Meeting** **Carter Hotel – Cleveland** **(Auspices of Diesel-Engine Activity, Fuels & Lubricants Activity and Cleveland Section.)**
June 9-10	**SAE War Material Meeting** **Book-Cadillac Hotel – Detroit** **(Auspices of Truck and Bus Activity, Passenger-Car Activity, Production Activity and Detroit Section.)**
Aug. 19-20	**SAE West Coast Transportation and Maintenance Meeting** **San Francisco, Calif.** **(Auspices of four West Coast Sections.)**
Sept. 23-24	**SAE National Tractor Meeting** **Schroeder Hotel – Milwaukee**
Sept. 30-Oct. 2	**SAE National Aircraft Engineering and Production Meeting (Semi-Annual)** **Biltmore Hotel – Los Angeles**

■

Kansas City – June 21

Continental Hotel; dinner 6:30 p.m. Manufacturing Processes in the Production of Tubing Utilized by the Aircraft Industry – J. P. Dods, director of research, Summerill Tubing Co.

Metropolitan – June 17

Hotel Edison, New York City; dinner 6:30 p.m. Fundamental Requirements of Post-War Transport Airplanes – Charles Froesch, chief engineer, Eastern Air Lines, Inc.

Milwaukee – June 4

Westmoor Country Club; dinner 6:30 p.m. Annual Ladies Night. Speaker to be announced.

Northern California – June 8

Engineers Club, San Francisco; dinner 7:00 p.m. Modern Filter Developments as Applied to Fuel and Lube Oil Systems of Diesel Engines – Charles A. Winslow, pres., Winslow Engineering Co.

Oregon – June 11

Heathman Hotel, Portland; dinner 6:30 p.m. Fundamentals of Lubrication – G. L. Neely, manager, Lubricants Division, Standard Oil Co. of Calif.

Southern California – June 11

Hollywood Roosevelt Hotel, Los Angeles; dinner 6:30 p.m. Subject – Aircraft Tooling. Speakers to be announced.

About SAE

Eight SAE Members on National Aircraft War Production Council

Officers, directors, and Army and Navy associates of the new National Aircraft War Production Council, Inc., who met following the organization meeting in Los Angeles on April 13. The new organization is composed of the Aircraft Production Councils of the East and West Coasts, and is headed by GLENN L. MARTIN, president of Glenn L. Martin Co. and also president of the East Coast Council. Besides Mr. Martin, three of the six directors of the new NAWPC are SAE members. Seated, left to right, Frank F. Russell, president of National Aviation Corp., who is on leave of absence to become the general manager of NAWPC; J. CARLTON WARD, JR., director of the new organization and president, Fairchild Engine & Airplane Corp.; President Martin; Vice-President La-Motte T. Cohu, chairman and general manager of Northrup Aircraft, Inc.; T. Claude Ryan, president, Ryan Aeronautical Corp., and Lawrence D. Bell, president, Bell Aircraft Corp., both NAWPC directors. Standing, l. to r.: Dr. A. E. Lombard, WPB; Col. Nelson Talbott, AAF, LOUIS CLIFFORD GOAD, general manager, Eastern Aircraft Division of General Motors Corp.; ROBERT E. GROSS, NAWPC director and president, Lockheed Aircraft Corp.; HARRY WOODHEAD, president, Consolidated Aircraft Corp.; J. H. KINDELBERGER, president, North American Aviation, Inc.; GUY W. VAUGHAN, president, Curtiss-Wright Corp. and Wright Aeronautical Corp., Courtlandt S. Gross, president, Vega Aircraft Corp.; RALPH S. DAMON, president, Republic Aviation Corp.; Col. Donald F. Stace, AAF; Capt. Lucian Grant, USN; and I. MACHLIN LADDON, executive vice-president and general manager of Consolidated Aircraft Corp. The new Council represents 90% of the aircraft manufacturing interests in this country and an aggregate backlog of more than 17 billion dollars.

LT.-COL. AL BODIE has completed his mission at General Aircraft Corp., Astoria, L. I., N. Y., and is now assigned to administrative duties with the Eastern Procurement District of Materiel Command, War Department, Army Air Forces, New York City.

Transfer of **J. MITCHELL WATSON** from WPB in Washington to the position of metallurgist for the Tank-Automotive Center, Detroit, recently took place. Mr. Watson had been technical adviser to the chief of Supply and Requirements Branch, Office of Civilian Supply, WPB.

HENRY A. MULLIN, who has been with the U. S. Forest Service since 1936, has been made superintendent of Equipment Service, Arizona-Texas area. Mr. Mullin had been superintendent of the U. S. Forest Service, Redding Shops, Redding, Calif.

RAYMOND Z. FARKAS has left his position as draftsman in the Diesel Division, Hercules Motors Corp., Canton, Ohio, and is now an ensign, USNR, Bureau of Ships, Navy Department, Washington.

MAJOR SIDNEY G. HARRIS has been ordered to foreign duty. His future address will be A.P.O. 4136, care of Postmaster, Miami, Fla. He was formerly chairman of the SAE Metropolitan Section.

At the annual meeting of the Ahlberg Bearing Co., Chicago, **FRED O. BURKHOLDER** was elected president. Mr. Burkholder joined the Ahlberg sales force in 1915. After serving as manager of several of the company's branches, he was made sales manager in 1926, and in 1928 was elected vice-president.

Fred O. Burkholder

FRED L. HALL is vice-president in charge of sales, Rogers Diesel & Aircraft Corp., New York City. He had been sales manager for the Bendix-Westinghouse Automotive Air Brake Co. In addition to his immediate concern with government contracts, Mr. Hall will be active in formulating plans for post-war sales.

Fred L. Hall

Members . . .

CAPT. EDWARD RICKENBACKER has announced his acceptance of the chairmanship of a general committee which will sponsor the National A.A.U. outdoor track and field championships to be held at Triborough Stadium, Randall's Island, New York City, June 19-20. This is part of Capt. Rickenbacker's campaign to raise $10,000,000 for the Army Air Forces Aid Society, organized a year ago to help the families of Army flyers after the war, and which is not permitted by military regulations to solicit money for its trust fund.

Formerly process engineer at the Curtiss-Wright Corp., Propeller Division, Caldwell, N.J., **CHARLES J. KALLINICK** is now connected with the General Electric Co.'s plant at Bloomfield, N.J.

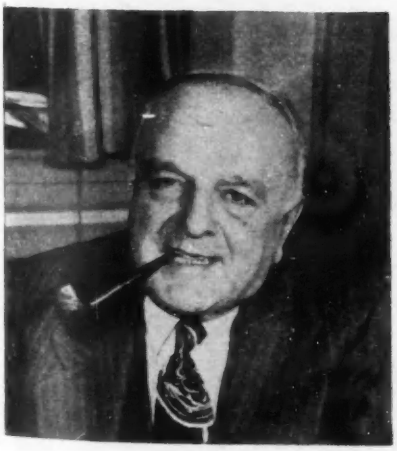
ROBERT Y. COPLAND, who had been factory manager of the Dominion Tire Factory, Dominion Rubber Co., Ltd., Kitchener, Ont., Canada, has joined the U. S. Rubber Co., New York City.

Formerly assistant mechanical engineer, U. S. Army Air Forces, Materiel Center, Wright Field, Dayton, Ohio, **SAMUEL NOOGER** is now with the Production Engineering Section, Specification Branch, Army Air Forces, Materiel Command, Wright Field, as associate mechanical engineer.

LT. CHARLES H. MARTENS, USNR, is at the U. S. Naval Air Station, Quonset Point, R. I. Before entering naval service in April, Lt. Martens was employed as an associate aircraft maintenance supervisor by the Air Service Command, U. S. Army Air Forces, Dayton, Ohio.

LT. FRANK N. SINGER has been transferred from the Letterkenny Ordnance Depot, Chambersburg, Pa., to the Ordnance Section, Columbus (Ohio) Quartermaster Depot.

The appointment of **EARL S. PATCH** as sales manager is announced by Henry L. Crowley & Co., Inc., West Orange, N. J. Formerly an executive of the Moraine Products Division of General Motors in Dayton, Mr. Patch is an authority in the field of powder metallurgy. He will make his headquarters in the company's main office.



Earl S. Patch

Lt.-Gen. William S. Knudsen, chief of production, War Department, confers with Ben F. Hopkins, president of the Cleveland Graphite Bronze Co., on a recent tour of inspection

HARRY C. WANNER is president of Headford Bros. and Hitchins Foundry Co., Waterloo, Ia. He had been president of Wanner Industries, Chicago.

LT.-COL. A. C. BIGELOW is in Headquarters, Army Service Forces, Stock Control Division, Arlington, Va. Col. Bigelow had been chief of division, U. S. Army, Ordnance Department, Holabird Ordnance Depot, Baltimore, Md.

IGOR I. SIKORSKY was one of the winners in the Sixth Annual American Design competition. Four $1000 awards were presented to American designers and inventors whose achievements were described as being of outstanding value in the war. Mr. Sikorsky, of Sikorsky Aircraft Division, United Aircraft Corp., has developed the helicopter, a rotary aircraft capable of vertical flight, which has been hailed as an important answer to submarine warfare, and also the four-motor amphibian, widely used as a passenger air liner.

Somewhere in the South Pacific, where for the past several months he has been on the islands with a major overhaul unit, **R. M. VAN EE** is part of the PT Fleet. Mr. Van Ee, whose address is Motor Torpedo Boat Base No. 3, Naval Advanced Base, Navy 212, in care of F.P.O., San Francisco, Calif., said in a recent letter to the SAE: "I am proud to be a part of the PT Fleet: our boats are small but pack a big surprise for intruders."

SAE Past-President **A. W. HERRINGTON** received the honorary degree of mechanical engineer at the 71st annual commencement exercises of Stevens Institute of Technology, Hoboken, N. J., held on May 1.

RALPH L. HILDEBRAND has left his position with Douglas Aircraft, Inc., Long Beach, Calif., where he was assistant maintenance supervisor, and is now equipment engineer for contractors of the Pacific Naval Air Bases, Port Hueneme, Calif.

The Office of Defense Transportation recently announced the appointment of **JOHN F. WINCHESTER** and **LEO HUFF,** petroleum transportation engineers, as consultants to the Petroleum Carriers Section of its Division of Motor Transport. They are serving part time as advisers on local delivery. Mr. Winchester, manager of the automotive department of the Standard Oil Co. of N. J., is in ODT's Washington office. Mr. Huff, chief transportation engineer for the Pure Oil Co., is located in Chicago.

R. W. MILLAR is now with the Vultee Aircraft Division, Aviation Mfg. Corp., Downey, Calif. Mr. Millar was formerly president of Vultee Aircraft, Inc., Vultee Field, Calif.

Recent United Aircraft promotions include those of **CHARLES J. McCARTHY,** who was elected a vice-president of the corporation with general supervision over airplane activities. He relinquishes his duties as general manager of the Chance Vought Aircraft Division at Stratford. **REX B. BEISEL** was named acting general manager of the Chance Vought Aircraft Division, retaining his present position of engineering manager.

ENSIGN RICHARD F. MARTIN is assistant officer superintendent of the Office of Inspector of Naval Materials for the U. S. Navy, Detroit.

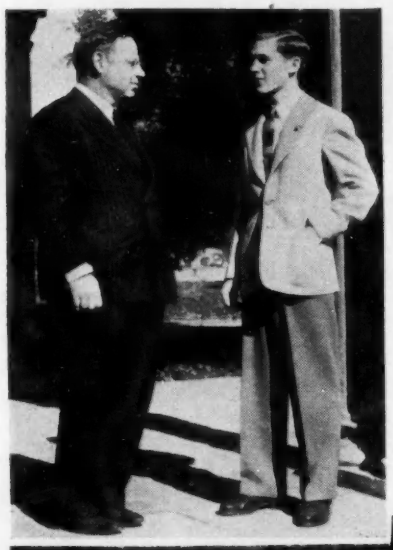
WILLIAM WADDELL, who had been chief draftsman, Lycoming Division, The Aviation Corp., Williamsport, Pa., is now special engineer at the Studebaker Corp., South Bend, Ind.

Recently **L. C. PESKIN** left the employ of the American Steel & Wire Co., Cleveland, to join the Kellett Autogiro Corp., Upper Darby, Pa., where he is working in the capacity of products engineer.

CAPT. BRUCE G. LEIGHTON, USNR, retired, who has been president of the Intercontinent Aircraft Corp., Miami, Fla., is now at the Office of General Inspector of Naval Aircraft, Western District, Los Angeles, Calif.

Formerly with the War Ministry, Ankara, Turkey, **CAPT. WALLACE BRENNAN** is now with the first battalion, 125th Ordnance MBS Regiment (Q), A.P.O. 678, c/o Postmaster, New York.

T. G. PRICE, who has been superintendent of automotive equipment, Shell Oil Co., Inc., Houston, Tex., is temporarily retired.



ROBERT S. OGG has left the War Production Board, Washington, where he was assistant chief, Industrial Internal Combustion Engine Section, Construction Machinery Branch, to join the Hooven, Owens, Rentschler Division of the General Machinery Corp. at Hamilton, Ohio.

RALPH H. KRESS, on leave of absence from his position of zone manager, Fleet Sales Division, General Motors Corp., Detroit, is a captain in the Highway Division of the Transportation Corps, Washington. **COL. FREDERICK C. HORNER** is chief of the division.

Formerly engineering manager of the Porterfield Aircraft Co., Fort Smith, Ark., **RICHARD C. GAZLEY** is now with the Cleveland Pneumatic Tool Co., Cleveland.

RUDY L. BRADSHAW, who had been equipment superintendent, Alaska Highway, Federal Works Agency, Public Roads Administration, Seattle, Wash., is now with the Treasury Department, Procurement Division, Federal Property Utilization Branch, Washington. Mr. Bradshaw is engaged in the rehabilitation and distribution of all types of Federal property.

JAMES W. CARL is no longer mechanical engineer with the Cleveland Pneumatic Tool Co., having left this position to become superintendent of Plant 2, Fleetwings, Inc., Division of Kaiser Cargo, Inc., Bristol, Pa.

JOSEPH P. van OVERVEEN has been commissioned a second lieutenant in the Ordnance Department of the U. S. Army. Lt. van Overveen, who is stationed at Fort Knox, Ky., has been assigned to the Armored Force School, Tank Department, as an instructor.

SYDNEY G. TILDEN, JR., who has been a member of the Army Enlisted Reserve at the Massachusetts Institute of Technology, has been called to active duty in the U. S. Army Air Forces, and is stationed in Miami Beach, Fla. He received his pilot flying license last year.

RICHARD TAYLOR is now owner and manager of Taylor's Ramapo Auto Service (formerly Ramapo Auto Sales Co., Inc.), Suffern, N. Y.

Formerly transportation officer, U. S. Army Air Forces, Headquarters 1st Air Force, Mitchel Field, L.I., N.Y., **LT.-COL. WILLIAM B. DROGE** has been transferred to Headquarters Air Service Command, Patterson Field, Fairfield, Ohio.

WILLIAM A. CRESSWELL, JR., Ranger Aircraft Engines, Division of Fairchild Airplane and Engine Corp., Farmingdale, L. I., N. Y., has been transferred from analytical engineer to junior project engineer in the stress and vibration department.

MAJOR-GEN. STEPHEN G. HENRY, commanding general, 20th Armored Division, Camp Campbell, Ky., was recently awarded the Distinguished Service Medal . . . "For exceptionally meritorious and distinguished service to the Government in a position of great responsibility in organizing and establishing the Armored Force School, Fort Knox, Ky. With meager facilities, a small nucleus of partially trained instructors, by great foresight, force of character, sheer ability and an exceptional knowledge of pedagogy, he has built up the Armored Force School until it is a model of efficiency. Gen. Henry, as commandant of the Armored Force School from July 25, 1940, to Feb. 24, 1943, contributed materially to the successful training of Armored Force units thus insuring their early departure for theaters of operations."

Formerly assistant project engineer, Vega Aircraft Corp., Seattle, Wash., **ALVIN J. KORNBLUM** is now project engineer, Hughes Aircraft Co., Armament Division, Hollywood, Calif.

Pictured here are some members of the SAE Student Club at California Institute of Technology. Several members have recently been called into service in the armed forces, or taken positions in industry. Abner Kaplan and Robert King have been called to active duty by the Army Enlisted Reserve Corps; Chairman Robert Krueger, by the Army Air Forces Officer Reserve Corps; Harold Hipsh and D. P. Wilkinson have taken positions with General Motors. Inset: Dr. Arthur L. Klein, sponsor, and Robert Krueger, chairman

R. J. Bender

R. J. BENDER, who for the past 11 years has been combustion engineer for the Sinclair Refining Co., Chicago, and editor of the monthly *Sinclair Firebox*, has joined the Navy Reserves as lieutenant.

KENNETH KASSCHAU, assistant project engineer, Wright Aeronautical Corp., Paterson, N. J., and vice-chairman of student activities, SAE Metropolitan Section, recently addressed the student chapter of the ASME, Newark (N.J.) College of Engineering, on the subject of aircraft engines.

GUNNAR JENSEN, formerly chief engineer of the Walker Mfg. Co. of Wisconsin, Walker Michigan Division, Jackson, Mich., has been transferred to the Racine Wis., office, in a similar capacity.

CAPT. ALVIN E. RAETTIG, Ordnance Department, has been promoted from lieutenant. Capt. Raettig is in the 183rd Ordnance Heavy Maintenance Battalion (Q), Fort Benning, Ga.

MAJOR LEA R. STAIGER is on overseas duty, American School Center, and can be reached through A.P.O. 645, New York.

C. C. CHAPMAN has accepted an appointment with the British Ministry of Supply as technical assistant in the Powerplant Section, Tank Design Department, Surrey, England. Mr. Chapman had been with Airspeed (1934), Ltd., Airport, Portsmouth, England, as section leader, Drawing Office, Pneumatics and Hydraulics Department.

SERGE L. CROWELL has accepted a position as helicopter designing engineer with Sikorsky Aircraft, Division of United Aircraft Corp., Bridgeport, Conn., and has left the Babcock & Wilcox Co., New York City, where he was designing engineer.

Formerly automotive engineer, Atlantic Refining Co., Philadelphia, **A. L. POMEROY** is now test engineer with Ranger Aircraft Engines, Division Fairchild Engine & Airplane Corp., Farmingdale, L.I., N.Y.

RICHARD W. COCHRAN, who has been manager of the St. Louis, Mo., office of The White Motor Co., has been transferred to Los Angeles in a similar capacity.

NEIL WILSON MANN, SR., is an apprentice seaman, stationed at the U. S. Naval Training Station, Great Lakes, Ill. He was formerly assistant chief of the Engineering Disbursement Section, Sub-Contract Division, Waco Aircraft Co., Troy, Ohio.

Harry Agerter

HARRY AGERTER has been appointed general manager of Aircraft Components. From 1929 to 1934 he was aeronautical inspector, Bureau of Air Commerce, Washington, and then chief of Airways Coordination Section and assistant director of regional offices, Civil Aeronautics Administration. In 1940 he became sales manager, Aircraft Division, Engineering and Research Corp., Maryland. During this period Mr. Agerter was also aeronautical consultant, Aircraft Priority Branch, War Production Board, Washington. Mr. Agerter will manage both the Van Nuys, Calif., and Wichita, Kan., plants.

Formerly a lieutenant (jg), Bureau of Ships, Navy Department, Washington, **LAURIE C. SMITH,** USNR, is now a first lieutenant, and is stationed in Africa.

FISKE R. JONES, who had been chief engineer and director of the Simonds Saw & Steel Co., Fitchburg, Mass., is now manager of the Darlington Plant of United Aircraft Corp.

Formerly junior test engineer at Wright Aeronautical Corp., Paterson, N.J., **EDWIN A. HARDY** is now a private first class, U. S. Marine Corps. He is in Company G, Candidates' Class, Marine Corps Schools, Quantico, Va.

REUBEN J. CORY was recently made general purchasing agent of the Wico Electric Co., West Springfield, Mass. He had been manager of the purchasing department of the company's Milwaukee branch.

Transfer of **HAROLD R. PORTER** from the Standard Oil Co. of Calif. to Transcontinental & Western Air, Inc., Kansas City, Mo., recently took place. Mr. Porter is in the engineering department of TWA.

COL. CHARLES DEERE WIMAN, is with the War Department, Office of Chief of Ordnance, U. S. Army, Washington, D.C. Col. Wiman was previously with the Tank-Automotive Center in Detroit.

In the April issue of the *SAE Journal* we stated that **E. W. GRIFFITH,** formerly with the F. A. Smith Mfg. Co., Rochester, N. Y., had joined the Morris A. Elliott Co., Baltimore, as department manager. Mr. Griffith has since informed us that he is a manufacturer's representative, and that the F. A. Smith Mfg. Co. has been, and is, one of his principal accounts. In fact, he is manager of their automotive division. He also represents the Morris A. Elliott Co.

The following SAE student members are now in military service: **ENSIGN JOHN L. HACKER,** USNR, formerly Case School of Applied Science, now with the Bureau of Ships, Navy Department, Washington; **ROBERT L. STEPHENS,** who received his degree of bachelor of science in aeronautical engineering from Texas A & M College, is now in Officer Candidate School, Fort Benning, Ga.; **RICHARD W. HUSHER, JR.,** formerly a student at Yale University, now in the U. S. Army; **RICHARD W. DAVIDSON,** formerly Detroit Institute of Technology, now in Company F, 289th Infantry, 75th Division, at Fort Leonard Wood, Mo.; **HOWARD JARMY** is an engineering aviation cadet, U. S. Army Air Forces, Technical Training Command, Boca Raton, Fla. He worked as assistant maintenance supervisor on Allison engines for the Air Service Command at Patterson Field, Dayton, upon graduation from the Illinois Institute of Technology, and enlisted in the Reserve Corps in December of last year. He was called to active duty in March. **ENSIGN EDWARD S. BENTLEY** can be reached through Naval Post Office 231, c/o Postmaster, New York City. He had been a student at Yale University. **PETER DARLINGTON,** formerly Yale University, now in the U. S. Army Air Forces, Abbott Hall, Lansing, Mich.; **THOMAS E. NOAKES,** formerly a student at the Lawrence Institute of Technology, Highland Park, Mich., was granted a leave of absence from the Detroit Lubricator Co., where he had been working as product designer, when he joined the Air Forces; **JOHN M. VALLANCE,** formerly University of Toronto, now a second lieutenant in the Canadian Army.

T. H. NAGLE has been appointed sales promotion and advertising manager of Sav-Way Industries, Machine Tool Division, Detroit. Mr. Nagle was with General Motors and Bendix Aviation Corp., and before that was president of his own company, Ted Nagle Equipment Corp., Detroit.

A. J. WEATHERHEAD, JR., president of the Weatherhead Co. of Cleveland, has outlined a proposal designed to bring the American people a stable prosperity, and a permanently high standard of living. Mr. Weatherhead told of his plan for the first

A. J. Weatherhead

time at a meeting in St. Thomas, Ontario. The proposal is for an economic committee made up of Government appointees from the ranks of business and labor.

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Technical IDEAS for ENGINEERS

Briefed from Papers given at SAE SECTION MEETINGS

Research

Results Will Make New Post-War World

by A. W. HERRINGTON, Marmon-Herrington Co., Inc.

▪ **Canadian, May 7**

(Excerpts from paper entitled "Our Part in Post-War Industry")

RESEARCH is pushing outwards the frontiers of industrial opportunity at a rate which we could not possibly conceive two years ago.

In our urgent search for means of locating enemy air and water-borne military units, we have turned to electronics with amazing results. These developments will bring greater changes to our every-day post-war life than did the coming of the radio. All sorts of labor-saving controls will come from the ultimate commercial development of these new discoveries. The wireless transmission of electrical energy is a not-too-far distant possibility.

Electrons originally harnessed only in radio tubes are now our able laboratory assistants in a much broader field. The photo-electric cell is becoming the "seeing eye" of industry. The electron microscope is daily increasing our knowledge of the physical structure of matter.

The complicated chemistry of the hydrocarbon is unfolding under our improved knowledge in the use of catalysts. The "octane" ratings of our aviation fuels are soaring upwards. Non-inflammable fuels of high energy content which will not burn in open air have already been created. At present our fuel developments have outstripped the ability of our motor designers to use these new sources of energy.

In the laboratories of my own company we have been studying the problem of test engines to evaluate properly the energy content of these new chemical creations. One of these special test engines is already running with an imep of 500 psi and another engine which has been especially designed to operate upon small quantities of these fantastically expensive samples will develop an imep of 850 psi.

To those of us who have considered the airplane as a possible transporting medium of the world's goods in commerce, these discoveries open a new field of possibilities.

The reduction of the ton-mile cost of transportation of cargo is determined by the speed and the laden to unladen weight ratio. There seems little hope of any radical change in the specific weight of the materials out of which an airplane can be built. Our efficient use of the materials available has already attained a high standard. Obviously the one factor still open to attack is the volume of fuel required to be carried and the energy content of this fuel.

Airplanes capable of carrying a capacity load and spanning the Pacific non-stop bring no comfort to our enemies and leave us with a few post-war problems of our own.

Our knowledge of aerodynamics is also undergoing a major revision and revolution. As we attain aircraft speeds in excess of 500 mph, things do not seem to be as they were before. Air starts to react in ways to which we are not accustomed. Air screws commonly called propellers do not function as we have expected them to.

Jet Propulsion Aids

When propellers are no longer efficient we must turn to orifice or jet propulsion. Such sources of propelling power, exceedingly efficient at high altitudes, have presented some low altitude problems we are just on the verge of solving.

The airplane which can be flown by the individual of average physical qualifications is even now available. The impetus of post-war industrial development will so reduce its cost as to broaden its useful field to unpredictable proportions.

The new control and development of catalysts has opened other fields to our chemists. The whole catalytic field is emerging from the days of the long and costly use of the Edison method. By new microscopes we can mathematically determine the kind of catalyst needed and predict the resultant reaction.

Synthetics of all kinds have been developed and we may never again turn to our old sources of supply for certain basic raw materials.

In the field of metallurgy the necessities of our war economy will provide us with many new materials which have formerly been too expensive for industrial use. The physical properties of our basic steel have been improved to the point where its possible use is materially expanded. Beryllium and boron are coming into commercial use as alloying agents.

Beryllium Used

Two metals possessing most unusual properties have come into common use. These are beryllium nickel and beryllium copper. Beryllium copper was the means of solving one of our aviation headaches. The high altitudes which are today a definite military requirement present real design problems in aircraft accessories. We were recently required to develop an air compressor which is capable of compressing 60 cu in. of air at 1000 psi at 40,000 ft altitude in 20 min at −70 F. This performance was made possible by a beryllium copper valve of unique and unusual design.

SYMPOSIU on

Aircraft Lends Itself to Hydraulic-Electric U

by WALTER C. TRAUTM
Bendix Aviation,

THE basic reason for utilizing a hyd electric combination is simply an at to skim off all the good points of hyd and electrical systems, hoping that the due or the bad points remain behind.

Remote controls can be broken into two distinct usage categories, air the problems surrounding each ca may be quite different.

Group I – Remote positioning co whereby an operator is able to contr curately and positively the motion power actuating device at considerable tances.

Group II – Automatic remote positi controls wherein the remote positi control becomes an integral part automatic control system.

The prime difference between the groups is that in the first, a manual effort is effected by an operator and power unit follows it exactly – at the time moving a heavy load; whereas in second group, an automatic control is exerted by some variable device as a sylphon bellows or change in ele resistance, and this is converted to mechanical corrective force designed to the system back into balance if it has disturbed. One can readily see that either case the only variation is the means.

One of the most prominent factors ing to the use of hydraulic-electric systems is the general arrangement of aircraft itself. A conventional airpl built in a tee shape as regards wing fuselage, with the distribution of pow

on REMOTE CONTROLS for AIRCRAFT

▪ Southern California, April 16

the majority of accessories being spanwise.

That part of the circuit going from the wing to the pilot's compartment can be considered a control circuit, whereas the spanwise circuit is the power circuit. Since the energies involved in a control circuit are small, it becomes a decided weight and space advantage to make them electrical. However, in a power circuit, much larger amounts of power are being handled, and hence the use of a hydraulic circuit here affords a weight saving, as we are now utilizing hydraulics more efficiently.

A further consideration is the lesser amount of space taken up by wires in the control circuit, since space in the pilot's compartment is always at a premium. This holds true in the power circuit, except that here there is usually ample room available and the larger hydraulic lines can easily be accommodated.

Thus, the combination system blends in very well with the aircraft structural requirements. In addition, the placement of the hydraulic devices at the junction of the tee makes for easy serviceability in case of mechanical failure.

There are some disadvantages in the mixed system also. The biggest of these is the fact that the system relies on two sources of power and is hypothetically twice as capable of failure as a single power system.

However, one must bear in mind that remote controls are only useful and practical on extremely large aircraft and such planes are vitally dependent on both hydraulic and electric power systems, and consequently, the designers of such systems will exercise much more care to prevent potential failures. Large aircraft are much more readily serviceable while in flight than smaller aircraft and can in the major-

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Isodraulic System Passes Low Temperature Tests

by J. W. KELLY,
Adel Precision Products Corp.

THE typical aircraft hydraulic system consists of a power source, a selector valve, and an operated unit. The power source provides the pressure to the selector valve, which in turn selects the operation to be performed by the unit – usually a hydraulic cylinder. This type of system provides for two extreme positions of the controlled mechanism, but intermediate positions may be obtained by closing the valve when the desired location is reached, thus shutting off the power source and locking the cylinder.

The type of hydraulic remote control about which I am to talk differs considerably from the typical hydraulic system. It consists of a master unit with a hand-operated handle which either controls the power source or provides the power itself. This particular remote control system is different from the typical hydraulic system in that the master provides both the power source and the selection; the slave unit, which is equivalent to the cylinder in the typical hydraulic system, is synchronized to the master – as the master moves, so moves the slave.

A little over a year and a half ago, Adel started development work on this general type of hydraulic remote control. Sixteen types of systems were considered; three were developed and thoroughly tested.

First to be developed was the power-operated single-line system, designed to operate from the high-pressure hydraulic supply source available in current types of aircraft. The single line was considered

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Sees Gradual Switch to Electric Remote Controls

by W. P. LEAR,
Lear Avia, Inc.

I HAVE with great interest witnessed the aircraft industry eagerly grasp and employ the advantages of electric remote controls, and I've seen the "slow-but-sure" trend and transition from hydraulic to electric methods.

Electric control was faced with, first, some way to rid the system of the stored energy of the high-speed motor armature to prevent coasting when the circuit to the motor was opened. The electromagnetic clutch and brake answered that problem. Also, the weight of commercial motors was excessive. Changing the supporting structure to light-weight metal such as aluminum or magnesium didn't help much. However, homogeneous designs utilizing the iron and copper more efficiently did the trick. Still electric loads were too great; more efficient gear design reduced both the current necessary, and the size and weight of the gear box.

However, there still existed the problem of limit switches. They were fine when they worked and most always they worked – unless someone improperly adjusted them or the cams that pushed them.

A very simple circuit has been developed to take the place of limit switches and circuit breakers, thereby eliminating the necessity of running the high-current wires up to the pilot's switch. The pilot is provided with the usual three-position type of switch.

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At Canadian Section meeting: SAE Past President Ralph R. Teetor; Canadian Section Chairman J. H. Hickey; and the speaker, SAE Past-President A. W. Herrington

New hard metals for cutting tools are speeding up our manufacturing processes.

The light metals, aluminum and magnesium, have experienced phenomenal development.

New processes for the extraction of aluminum from lower grade bauxite ores have materially increased our sources of supply. New and larger producing capacity for strips and shapes with corresponding reduction in cost will broaden the use of these materials in our post-war world. We may find an increasing use of aluminum in railroad cars and automobiles.

Magnesium, which is about 60% of the weight of aluminum, has been through similar production development. When this war is over we will be producing twice as much magnesium as we were producing aluminum in 1939.

Out of these new developments in high tensile steel and aluminum may easily come some radical changes in our post-war auto-producing industry. As one who is active in both industries it may be possible for me to hazard an answer to the recently expressed fears of the airplane manufacturers that the automobile men may invade the aviation field when the war has ended. It seems to me that there is far greater chance of the wide-awake aircraft designers applying their newly-acquired skills to the problems of automobile design and production, because our post-war motor car will definitely be lighter and more economical to operate.

Glass in the past two years has developed more possibilities than in all the prior years of its existence combined.

Surely from all of this accelerated research our industry will not be short of product possibilities. With the increased plant and producing facilities we have created, and with the shortage of all types and characters of goods existing, we will have a domestic economic pattern which should assure adequate post-war employment

Sees Transoceanic Service Of 500 or More Passengers

by M. B. CRAWFORD,
Pump Engineering Service Corp.

▪ Cleveland, Feb. 8

(Excerpts from paper entitled "Air Transportation and Maintenance.")

TO those of us who have been working in the aircraft business, the phenomenal progress of aviation in the last 20 years does not seem so apparent until we stop, look back, and recall. There are times when, as you go along from day to day, the progress seems very slow, but when you stop and recall all the progress that has been made in the last few years, it is almost overwhelming.

In the days of the first World War, advancements in aircraft design took a tremendous impetus – from the kite-like open-air contraption of the early airmen to the semi-enclosed fuselage and cockpits, and even entirely closed airplanes were introduced at this time. Air foils for the wings moved into the picture. The advancement in aircraft engines was phenomenal.

During World War I and the post-war era, our Post Office Department had been exceedingly active and farsighted in encouraging and keeping the spotlight on airmail possibilities. In 1925 the Kelly Bill was passed, providing for the transfer of airmail operations to private contractors within the limits of this country.

1927 was a great year in transportation . . . Lindbergh flew from New York to Paris . . . private contractors absorbed nearly all of the Government's airmail systems . . . Boeing Aircraft started the manufacture of the 40-A Aeroplanes to take care of the ever-increasing mail and passenger loads . . . Ford, Fokker, and Curtiss were all making their contributions to better passenger accommodations and larger airplanes . . . passenger fares were decreasing.

Between 1930 and 1940, the airlines forged steadily ahead and criss-crossed the country like a woman's snood. In 1936, many of the airlines consolidated and entered into a contract with the Railway Express Co. to carry air express in addition to the mail. Improvements in engineering, propellers, equipment, instruments, motors, and so forth, were so rapid that any one designer was unable to keep abreast of all these changes and improvements, and was forced to specialize.

It was during this period that two-way radio communication between the ground and pilot was presented and developed on the airlines. This could be classified as one of the greatest technical advancements since the installation of beacon lights, which radio was later to replace. The Government has now established regular radio highways along the majority of airline routes with definite rules and regulations concerning the procedure along these highways.

Overhaul Bases

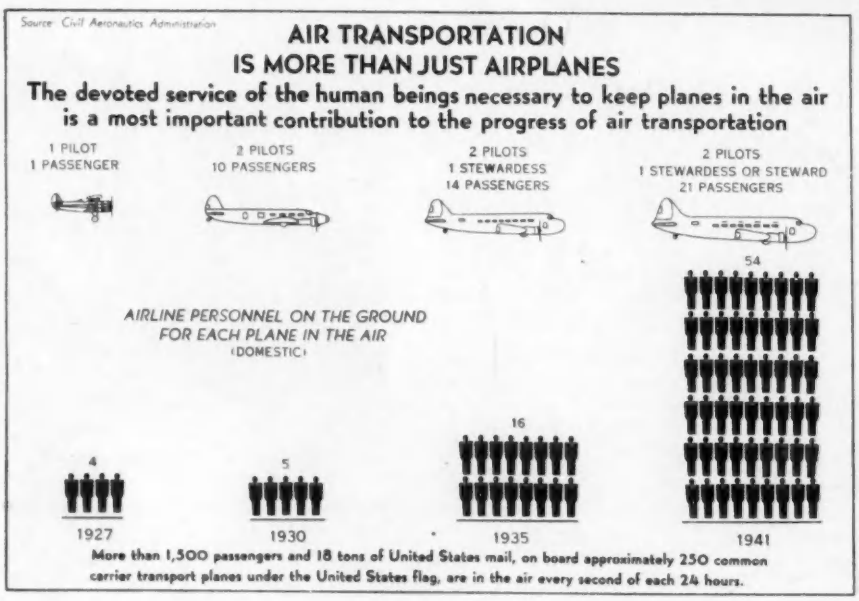
All major airlines have large overhaul bases which are complete small factories in themselves. These overhaul bases are usually located at strategic points on each airline system so that a minimum amount of time is lost in routing aircraft to this point from any part of the line. After every 750 hr of flight, the airplane is routed to the overhaul base where it is placed in docks for a complete overhaul. After every 6000 hr, the airplane gets the major overhaul, which amounts to complete rebuilding of the airplane. This includes all items on the complete overhaul, and in addition, all ribs, gussets, and structural members are checked, inch by inch. Bolts, skin, and hundreds of rivets are replaced. When the airplane comes out of this overhaul, it is a new airplane.

Future Aircraft Developments

I expect to live to see the day when transoceanic passenger service will be in airplanes that carry 500 passengers or more. I expect to see the engines enclosed inside the wings, and two or more engines connected to the same propellers in such a manner that one engine can be completely shut down, overhauled, and put back into service during any one particular flight. Passenger accommodations will exceed the comforts given now in even the most luxurious ocean-going liner.

The helicopter without question will take its place among the new peacetime developments after the war. It will be able to rise vertically, and descend vertically and should be very suitable for personal use.

I do feel that the advancements in aircraft to date have only scratched the surface, and what we will see in the future will make us smile at the elementary aircraft of today.


Source: Civil Aeronautics Administration
AIR TRANSPORTATION
IS MORE THAN JUST AIRPLANES
The devoted service of the human beings necessary to keep planes in the air is a most important contribution to the progress of air transportation
1 PILOT
1 PASSENGER
2 PILOTS
10 PASSENGERS
2 PILOTS
1 STEWARDESS
14 PASSENGERS
2 PILOTS
1 STEWARDESS OR STEWARD
21 PASSENGERS
AIRLINE PERSONNEL ON THE GROUND
FOR EACH PLANE IN THE AIR
(DOMESTIC)
4
5
16
54
1927
1930
1935
1941
More than 1,500 passengers and 18 tons of United States mail, on board approximately 250 common carrier transport planes under the United States flag, are in the air every second of each 24 hours.

Plane Production Ever-Changing Task

by GEORGE A. ARNOLD
Commonwealth Aircraft, Inc.

▪ Kansas City, April 26

(Excerpts from paper entitled "Aircraft Manufacturing Problems.")

THE word "production" indicates making things in large quantities, according to a carefully planned system whereby each and every unit produced is similar to every other unit in dimensions, functions, and quality. Therefore, when we speak of production of airplanes, we must scale down our concepts, which are based on the more commonly produced articles like automobiles, refrigerators, and radios.

Since weight-saving has always been, and still is, of paramount importance in an airplane, the detailed design of the component parts has been of complex and "difficult-to-build" types. The designer did his best as he saw it, but he was always faced with several serious "bugaboos," the chief two of which probably were lack of suitable materials and lack of adequate machinery and tools with which to produce.

A military airplane can serve only one purpose, and from a military point of view, the airplane and its complicated structure are secondary to the armament. The complicated problems of powerplants, which must operate through wide ranges of temperatures, is alone a tremendous one.

The modern military airplane engine must function in desert temperatures running well over 100 F, and within 5 or 10 min may have climbed to altitudes where operating temperatures are many degrees below zero.

Gun fire control is very complex and requires a maximum of close-tolerance production facilities.

The word "production" must become a relative term, and it is hardly fair to try and evaluate production of airplanes in terms of production of automobiles. As recently as 1939, an order for 300 pursuit ships of any one given type was a large quantity to be ordered from any one manufacturer.

Now we find ourselves in the middle of a war, and although the quantities of planes of any given type that are placed in production are relatively large, we must appreciate that continual changes are mandatory. Some

of these are due to the immediately existing competitive types that the enemy is able to put into the field. Some of them are due to changes in the tactics currently used by our own operating air forces.

Thus, the problem of airplane production is an exceedingly complex one, which calls for the utmost in ingenuity on the part of engineers, tool designers, and factory workers who have to build and assemble the parts. We must, therefore, accept the fact that in this business everyone must strive to the utmost to help keep the production organization flexible, ingenious, and willing to use every resource at its command in order to avoid costly delays in time required to make necessary changes.

There are two parts to this question: one part is to try, by proper tooling and full utilization of the most appropriate machinery and methods, to save every possible hour on such portions of the plane as are fairly well stabilized. The second part is to have available the above-mentioned resourcefulness and the man-hours saved to get us over the difficulties caused by mandatory changes in design or construction.

It might be well to pass on a few observations of what goes on in some of the other countries of the world. We are prone to consider that in our country we lead in all forms of manufacture and surpass the world in productive ability. We have much that we can teach to peoples in other lands. We also have much that we can learn from those same other peoples.

Plane Factory in China

Some eight or nine years ago it was my privilege to go out to China and help put into operation the first modern airplane factory that had ever been established in the country. This factory was thoroughly modern in every way – there was no holdover of antique equipment.

A total of 10 Americans tackled the job of getting the plant into operation. It was necessary, of course, to set up a training program, but there were 450 million people from which to draw the technical and working forces. They had ample reservoirs of people who had basic training in the manual arts. It was only necessary to acquaint them with the machinery and tools that were required for airplane production.

Within about four months, the plant was turning out modern, all-metal medium bombers for the Chinese Air Corps. This plant, which was completed in the summer of 1934, operated until the early Fall of 1937, when it was destroyed through bombing by the Japanese.

From this narrative, I wish that every manufacturing executive, every engineer, and every business man would come to the realization that in addition to hundreds of thousands of technicians in our country, there are millions of people with skill potentially equal to ours.

We have discussed certain things that possibly facilitate production. It may now be in order to enumerate a few things that do not facilitate production. Some of these are: filling out Government forms; complicated "systems," which are products of modern big organizations; "directives" issued by well-intentioned management to keep control of the business, but which contribute little.

In order for progress to continue, there must be a never-ending striving for simplification of design. Some of the detailed design of the thousands of parts that go to

Rambling Through Section Reports

MOTION pictures are getting more popular at SAE Section meetings as the months go on. BUFFALO had "Army on Wheels"; KANSAS CITY saw "Thunderbolts over the Pacific," a pre-war trip to China, India and the Malay Peninsula; and the COLORADO GROUP, "The World's Largest Electrical Shop" and "Television" . . . all at recent meetings . . .

Tests in Driver Training Programs, described at PHILADELPHIA SECTION'S April meeting, *would put most of us on the waiting list* . . .

A G-man covered the WASHINGTON SECTION on April 19 . . . *E. P. Coffey,* chief, technical laboratory, FBI, said sabotage consists mostly of individual acts inspired by (a) revenge, (b) resented company orders, or (c) general sympathy for the Axis. Not one of thousands of cases investigated has been caused by organized enemy agents. Answer: The FBI took precautions *before* Pearl Harbor . . . Another interesting message was the one brought to ST. LOUIS on April 22. *Lt.-Col. Richard W. Coward* revealed that Ordnance is so far ahead in production that manufacturing curtailments are necessary to make output fit available shipping space . . .

Reports are in from three more sections on talks by *SAE President Mac Short.* He told NEW ENGLAND, SOUTHERN NEW ENGLAND, and the STUDENT BRANCH at the California Institute of Technology (CALTECH SAE CLUB) how the Society is serving in the war effort . . . and predicted a vast increase in air cargo after the war, with corresponding decrease in ton-mile cost . . .

. . . While Rensselaer Polytech Aeronautical Prof. *A. J. Fairbanks* was heralding a great post-war future for lighter-than-air craft to a MOHAWK-HUDSON-GROUP meeting. Lighter-than-air ships can eliminate time taken in getting to and from airports by having a city-center mooring mast, argues Prof. Fairbanks, who is credited with organization of the first glider club in the United States.

Talking Boundary Film Lubrication at MID-CONTINENT SECTION meeting on May 7, Alox Corp.'s *Dr. A. W. Burwell* showed how orientation of polar compounds on the surface of a bearing or journal makes tough adherent film preventing metal-to-metal contact in a bearing . . . Silver good only to dilute and reinforce some better metal like cadmium . . . experience with gold and platinum is costly, therefore meager . . .

Enormous power generated in testing of engines supplies over half of power needed at the Buick plant . . . reported *D. R. Hoover,* production engineer of the Buick Aviation Engine Plant, to the SAE MUSKEGON CLUB on March 26.

Along with *President Short,* NEW ENGLAND on April 15 heard *Com. A. H. Ellis* say that the Navy had materially eased the home-fuel situation by converting much of its powerplant equipment from fuel oil to coal – and listened to a description of extensive use of automotive equipment by both Army and Navy from *Lt.-Col. C. A. Allen* . . .

During 15-min blackout on May 7 members and guests of CANADIAN SECTION lustily sang songs popular with the fighting forces of the Allies of both World Wars . . .

make up a modern airplane are very complex. To the production-minded man they are often unnecessarily complex. These are the headaches of the engineering department, the tool designers, the planners, the material procurement people, and the men who actually manufacture the parts.

'Buna S' Duplicates Many Rubber Qualities

▪ Metropolitan, April 15

(Summary of "Chemical Background and Manufacturing Applications of Petroleum Synthetics," by George H. Freyermuth, Standard Oil Co. of N. J.)

"Buna S" rubber was used in Mr. Freyermuth's discussion of synthetic rubber since it represents more than 90% of the synthetic rubber being produced in the country at present.

"Buna S" rubber, while it duplicates more of natural rubber's properties than any other synthetic – and actually possesses some properties superior to natural rubber – cannot yet replace natural rubber in *all* applications, he said. In many cases, including tires, a combination of natural rubber and "Buna S" has provided a satisfactory product and thereby conserved our natural rubber reserve.

He presented a film entitled "Bouncing Molecules," which illustrated the atomic combinations of carbon, hydrogen and oxygen that must be obtained to have synthetic fuel or rubber. Various colored balls representing 100 million magnifications simulated the three elements, and molecular structures starting with the simple Methane gas and building progressively up through propane and butane to the Butadiene and other polymers, were shown and explained.

As an example to show that the production of synthetic rubber from petroleum would not noticeably affect the output of fuels and other petroleum products, Mr. Freyermuth stated that the *yearly* rubber requirements of the country could be met by one day's output of petroleum.

With the use of slides, Mr. Freyermuth showed that 100 octane fuel can be obtained by various combinations of synthetic Iso-Octane, a high octane base and lead. Synthetic Iso-Octane would, in itself, meet the 100 octane requirement, but in order to provide sufficient production and maintain a low cost, a combination with a high octane base and lead is being used. On the matter of cost, development of synthetic Iso-Octane has reduced the cost of 100 octane fuel from $20 per gal in 1922 to 15 cents in 1942, he said.

Toulene, the third synthetic in Mr. Freyermuth's discussion, was noted as simply another arrangement of the three elements: hydrogen, carbon and oxygen. Charts were shown depicting the amazing part synthetic Toulene production is playing in the manufacture of explosives, and it was stated that, at present, four out of every five barrels of TNT produced are manufactured from synthetic Toulene.

K. D. Smith, assistant to the vice-president in charge of production for the Goodrich Tire Co., passed around to the members and guests present a sample of Buna S rubber. He briefly commented on some of the production and development problems related to tires, noting in particular that many phases of the vulcanization process had been changed to accommodate synthetics.

Higher Voltage System for Starting

▪ Chicago, April 13

(Summary of "Storage Battery Performance at Low Temperature," by John H. Little, Chevrolet Motor Division, General Motors Corp., and Robert A. Daily, Delco-Remy Division, General Motors Corp.)

SPEAKER Little, reviewing the electrical characteristics of the four battery types – 2H, 4H, 7H, and 8T – generally used in military vehicles, showed, by a series of curves, data on battery performance at low temperatures as compiled in a series of tests at various temperatures as low as —40 F.

Advantages of the higher voltage system for starting were stressed by the speaker, citing a specific case of an engine which, with a 6-v battery, would require approximately 480 amp to crank, but with a 24-v battery, would require only about 120 amp. In the latter case, four 7H batteries are used and the cranking is quite readily accomplished, said Mr. Little, with the batteries at —40 F. This particular case, he pointed out, involves a gasoline engine, and ignition voltage during cranking is about 19 to 20.

By paralleling batteries, he said, lower temperatures and lower system voltages may be used. Briefly, the higher the discharge rate, the higher the battery temperature must be. In the 6-v system, the operating regulated voltage is usually 7 to 7.1, Speaker Little declared, and with a 24-v system it is about 27.5 voltage and one-fourth of this is 6.87 v. This means that it will be better to warm the battery to 40 F for charging.

The battery installation, said Mr. Little, must be adapted to the performance required under a given set of temperature and engine conditions. It should be insulated or kept warm to be usable; if allowed to get too cold, it must be warmed up; it must be kept in a good state of charge to prevent freezing; it must be further warmed while the vehicle is in operation to permit charging.

Discussion

Following Mr. Little's presentation, H. D. Wilson, Storage Battery Division of the Electric Auto-Lite Co., Toledo, said the key to impaired battery performance following the paralyzing effect of temperatures of —40 F and lower is in the behavior of the sulfuric acid electrolyte in the battery. Strength of current, he pointed out, is dependent on maintaining a high concentration of acid at the grid surfaces, but since at —40 F the viscosity of the acid is 12 times as great and resistivity is nearly seven times that at normal temperatures, the best answer for improved performance in cold weather seems to lie in an increased number of thinner plates per cell.

As a result of tests made with thinner plates, Mr. Wilson's company plans to increase the total number of plates per cell from 15 to 17 in the 2H size, from 19 to 23 in the 4H size, and from 25 to 29 in the 8T size. The new minimum plate thickness will be 0.080 in. for the positive and 0.070 in. for the negative plates. Another advantage gained by this method, he explained, is to reduce the distance between the plates to a minimum of 0.067 in., which gives a shorter liquid path between plates, partially compensating for the high resistivity of the acid.

Tests at 0 F showed the new 2H thin plate type delivered 14% greater capacity and the new 4H thin plate type 12% greater capacity than the respective current models. At —43 F the new 23-plate type delivered 21% greater capacity than the present 4H type of 19 plate. In aircraft batteries, cold temperature performance, said Mr. Wilson, is somewhat improved by using acid with a 1.320 sp gr (at 80 F), as confirmed by Russian experience, but the higher gravity of acid is not favorable to battery life.

Capt. Benjamin Rozett, maintenance officer, Sixth Service Command, Chicago Ordnance Shop, relating experiences in handling automotive equipment in extreme low temperature, declared that there was a need for better instrumentation in checking primary circuits and asserted more attention should be paid to standardization on fewer types of batteries in order to simplify service work on battery equipment. Among other commentators in the discussion were G. D. Gilbert, Illinois Bell Telephone Co., T. M. Robie, Fairbanks, Morse & Co., H. G. Smith and V. L. Durrstein, the Buda Co.

This paper was presented at the SAE War Engineering Production Meeting (Annual Meeting), Detroit, Jan. 15, 1943, and appeared in full in the May, 1943, SAE Journal, beginning on p. 149.

Promising Future For Helicopter

▪ Southern New England, April 16

(Summary of paper by Charles L. Morris, Vought-Sikorsky Aircraft, entitled "The Vought-Sikorsky Helicopter.")

THE helicopter – a unique contrivance – is very easy to fly, very gentle in action, and promises to take a leading part in post-war aviation, predicted Charles L. Morris, helicopter test pilot.

He told how Igor Sikorsky started work in the first part of the century, but when the Wright Brothers flew, proving mechanical flight possible, all aeronautical effort was then concentrated on fixed wing aircraft. Mr. Sikorsky kept coming back to the idea of the helicopter, trying again about 1923, and again in the latter part of the 1930's, when the present program was started. He flew the first ship himself in the fall of 1939 and has been making flights regularly ever since. The first flights – at a very short distance above the ground – were purely of an experimental nature, but a two-place ship built for the Army recently flew at 5000 ft.

No effort has been made in cleaning up the present design from an aerodynamic viewpoint, he said, the main object having been to make it do what it is supposed to do. In this connection, Mr. Morris pointed out, although patents are held by other people on practically all the major aspects of the helicopter, Mr. Sikorsky was the first one to eliminate the mistakes of others and *put everything together so that it worked.*

Both two and three blades have been used in the main overhead rotor, which provides the lift. By controlling the tip of the rotor axis relative to the ship, the horizontal component of the lifting force produces flight in any direction, forward, backward, or sideways. The amount of lift may be varied by changing the pitch of all blades at once, this control being connected to the throttle so that opening the throttle increases the basic pitch.

News..

..OF THE SOCIETY

Reduction of Car Electrical Units Recommended by W.E.B.

Sweeping reduction in types and sizes of certain electrical units as a wartime conservation measure was recommended by the SAE War Engineering Board in a report made to the Automotive Division of the War Production Board. The units are for civilian passenger automobile installations, and some recommendations are based upon the prevailing 35-mph speed.

Reduction from 560 types of 6-v ignition coils, condensers, and generator field coils now in use to a total of 58 was recommended by the SAE group, eliminating 502 types of these units. Recommendations included:

Ignition coils: From 99 types of service coils to 8;

Generator field coils: From 378 to 36;

Condensers: From 83 to 14;

Circuit breakers: Breaker levers and points to be reduced to six;

Brush sets: To be eliminated entirely.

The report further disclosed that standardization and simplification of the following electrical units had reduced use of critical materials to the minimum practical level:

Distributor caps and rotors;

Starting motor field coils;

Armatures, generators and starting motors;

Relays;

Regulators; and

Switches.

Of the major electrical units, only generator and starter brushes do not lend themselves to standardization, according to the report.

The work on this project was done by the Committee on Conservation of Materials in Electrical Equipment of the Board, headed by Robert M. Critchfield, chief engineer, Delco-Remy Division, General Motors Corp., Anderson, Ind. His committeemen were J. E. Echlin, president, Echlin Mfg. Co., New Haven, Conn.; L. V. Larson, Delco-Remy Division; John A. Shank, manager, Parts and Service Division, and F. S. Stead, Electric Auto-Lite Co., Toledo; and Emil Zoerlein and August Toelle, Ford Motor Co.

TWEC Issues Five Reports; Continues Other Projects

FIVE reports – compiled at the request of Government agencies – were approved, one subcommittee was set up, and a number of miscellaneous projects were discussed at the April 9 and 30 meetings of the SAE Tractor War Emergency Committee held in Chicago.

The reports approved are:

1. "Fuel Requirements of Farm Tractors." This report gives the amount of fuel used per hr by rubber-tired tractors of various belt horsepowers. It was prepared by a special committee of TWEC at the request of the Transportation & Storage Division, Office for Agricultural War Relations, U. S. Department of Agriculture. Chairman of this special committee was L. B. Sperry, International Harvester Co.

2. "Rubber Tires vs. Steel Wheels for Farm Tractors and Implements." This report recommends that rubber tires be used on farm implements in future production and for replacement wherever possible, because of the higher efficiency of rubber-tired vehicles compared with steel-wheeled equipment. The data in this report indicate the power and fuel savings possible through the use of rubber tires. The committee recommends that tires be used in which sufficient crude rubber has been replaced by reclaim to give a life factor of 50% of previous production. Elmer McCormick, John Deere Tractor Co., was chairman of the subcommittee that worked on this problem, at the request of the Farm Machinery & Equipment Division of WPB.

3. "Cast Crankshafts and Camshafts." This report suggests that the substitution of cast for forged units in tractor engines should not be made an industry-wide undertaking; rather the individual manufacturer should be allowed to solve the problem to meet his own material procurement requirements. The change appears to be ill-advised, the committee believes, because of design and production limitations, and because the castings would require critical alloys that should be conserved at this time. L. A. Gilmer, Oliver Farm Equipment Co., was chairman of this committee, and the report was made to the Farm Machinery & Equipment Division of WPB.

4. "Cast-Iron-Backed Connecting-Rod and Main Bearings." This report to the Farm Machinery & Equipment Division of WPB advises against any attempt to substitute cast-iron-backed for bronze-backed babbitt-lined bearings on tractors, urging that the small amount of copper saved would not be commensurate with the technical difficulties that might arise due to lack of experience with the cast-iron-backed units. W. F. Strehlow, Allis-Chalmers Mfg. Co., was chairman of the committee.

5. A simplified list of tire requirements – including tonnage, types, and sizes – was approved by TWEC. This list was prepared by E. F. Brunner, for the office of Rubber Director. It is based on synthetic and/or reclaim tires having a maximum life about one-half that of pre-war tires. The Committee recommended that the new tires be accompanied by an explanatory statement, which is also to be added to the instruction book of the equipment, and which is to explain to the owner and the operator that the emergency reclaim and/or synthetic tires are not as durable as are pre-war tires and must be given special care or their life will be very short.

Other TWEC Progress

Continued cooperation between the TWEC Alloy Steel Committee and the SAE War Engineering Board Iron and Steel Committee was indicated in the discussion following the report of E. A. Petersen, Massey-Harris Co., on a recent meeting of the W.E.B. iron and steel group. It was suggested that each committee should have a representative or two at every meeting of the other committee.

Chairman O. R. Schoenrock, J. I. Case Co., reported that his Alloy Steel Committee is making a study of the various alloy-steel parts being used in tractors with a view to suggesting substitutes of carbon steel and steels containing the minimum amount of critical materials.

It was also indicated by Chairman Lavers that WPB might ask TWEC to act as a tire simplification committee, as well as to cooperate in a simplification program on models and sizes in the tractor industry.

The story of the W.E.B. Dust Committee, as presented in a report from L. S. Pfost, Massey-Harris Co., liaison between TWEC and W.E.B., brought an enthusiastic response for cooperation with this new W.E.B. subgroup. Since there are a number of tractor engineers on the W.E.B. Dust Committee, it was felt that the tractor industry's long background of experience on dust problems

would be made available in the development of more effective dust-proof equipment.

Mr. Peterson reported that the Self-Starter Committee of which he is chairman is making progress. This Committee was organized to investigate the problems that have arisen from the WPB order that limited the amount of copper allowed in tractors so drastically that the order in effect required the elimination of self-starters from newly built tractors.

W.E.B. Groups Set Up To Study Dust Problems

The sands of Africa have been directly responsible for the organization of one of the newest committees of the SAE War Engineering Board. Under the sponsorship of W.E.B. member Ralph R. Teetor, Perfect Circle Co., a Dust Committee has been set up to assist the Army in providing better protection against dust in military land equipment.

John Wood, Chevrolet Motor Division, is chairman of this committee. The other members are: Tom Ball, Chrysler Corp.; J. M. Davies, Caterpillar Tractor Co.; W. S. James, Studebaker Corp.; E. F Overholt, International Harvester Co.; E. H. Shepard, Chevrolet Motor Division; and R. L. Weider, White Motor Co.

At its first meeting, held on April 2, the committee organized three subcommittees:

1. Engine Cleaning. Mr. Ball is chairman.

2. Moving Parts (including clutches, controls, and throttle shafts). Mr. Overholt is chairman.

3. Electrical Equipment. Mr. Weider is chairman.

Subsequently, three full days of fact-finding meetings were held (April 9, 21, and 22).

April 9 was devoted to a questioning of Ordnance Department personnel who have been supervising tests at Phoenix and Indio, and the field representatives of industry who have supervised the test work at these two points.

April 21 and 22 were given over to meetings of the three subcommittees listed above, at which time representatives of all important manufacturers of equipment of all kinds affected by dust were brought together to discuss the various problems with the committee and members of the Tank-Automotive Center.

T-AC representatives at the meetings included Lt.-Col. J. M. Colby, chief of the development branch; Lt.-Col. A. B. Domonoske, development branch; Lt.-Col. E. F. Norelius, engineering branch; Capt. D. O. Nichols and Lt. W. C. Klein, Jr., both of the development branch.

New W.E.B. Committees Off to a Good Start

From the reports presented at the March 26 meeting of the SAE War Engineering Board, it is evident that the newly organized Aluminum and Plastics Committees are both off to a good start.

The four subcommittees (refer to *SAE Journal*, April, 1943, p. 24) of the Aluminum Committee have all met and discussed the basic problems that each has to study, and the Plastics Committee is working out a method of filing and cataloging data.

SAE Twin Cities Group Initiated

AT an enthusiastic meeting, May 13, 75 SAE members and guests of the Minneapolis-St. Paul area gathered at the Curtis Hotel for the organization of the SAE Twin Cities Group. Speakers were T. H. Risk of the Ethyl Corp., who spoke on "The Possibilities for New Motor Fuels," and Hollister Moore, manager of the Society's Sections Department, who congratulated the Group on its splendid start and told them something of the SAE's part in the war program.

Officers of the new Group, unanimously elected at the meeting, are: chairman, W. E. Swenson, Minneapolis Moline Power Implement Co.; vice-chairman, W. W. Lowther, Donaldson Co., Inc.; secretary-treasurer, T. E. Murphy, University of Minnesota. The slate was presented to the Group by Dewey E. Hult, Auto Engine Works, Inc., chairman of the nominating committee which had been elected at a pre-organization meeting.

Revealing that advances in the technique of making gasoline components promise large quantities of high-quality fuel for post-war vehicles and planes, Mr. Risk stated that refinery economics, post-war engines available, and other considerations, will determine much of the newer fuel components and how much of them will be used in motor gasolines.

"For the purpose of this discussion," said Mr. Risk, "an 'ideal' fuel is defined as one which will satisfy the antiknock requirements of any engine in which it is used throughout the entire engine speed range, but which will not possess any 'wasted' or excessive antiknock quality at any speed. The curves indicate that for a high compression engine the 'ideal' fuel is one in which the unsaturated or olefinic hydrocarbons are concentrated in the light fractions, while the saturated or paraffinic hydrocarbons are concentrated in the heavy fractions."

Isodraulic System Passes Low-Temperature Tests

continued from page 33

desirable in that it provided more simple installation. It consisted of a master unit, with an ingenious valving mechanism operated by the master control handle for controlling oil flow to and from the spring-loaded slave unit. Thus, as the master handle is moved in one direction, the valves allow the oil pressure to flow into the master unit, compressing the spring and moving the slave lever in phase with the master control lever. Several disadvantages were encountered which eventually led to its being discarded as an unsatisfactory remote control.

In order to eliminate the disadvantages of the single-line control, the dual-line power system was developed, whereby hydraulic pressure was applied at both ends of the slave cylinder and the spring return eliminated. To remove the effects of temperature changes, a hydraulic lock was incorporated in the slave unit, so designed that when the control was not being operated, both lines to the slave were open to return pressure. Thus, the fluid in the system could expand and contract at will without affecting the position of master or slave. However, since investigation of the compressibility of the oil came after this unit was completed, the "spongy" effects obtained were not anticipated.

The item which caused most of the trouble was leakage. Due to the many poppets required for the valving mechanism, leakage proved hard to control. Leakage at any one valve would put the entire system out of phase and could render it inoperative. It was therefore decided that the best way to reduce all of these difficulties was to get down to basic simplicity of design.

Thus, the Manual Isodraulic, or hydraulic remote control, was started. The master is designed to have the minimum of poppets and sealing members and incorporates the synchronizing and thermal change mechanisms. The slave unit, like the master, incorporates a minimum of seals and poppets and is provided with the same type of hydraulic lock as developed in the power dual-line system. Bleeding is amply provided for and the effects of temperature changes are prevented. The problem of low-temperature operation, which is the downfall of many other similar types of control, has been thoroughly investigated, and our tests, now nearing completion, indicate that this difficulty is eliminated.

In order to provide as much torque as is available with the hydraulic system, electrical controls will suffer severe weight penalties and – even worse – the "feel" of operation, highly desirable in many types of control, is lost. Also, electrical operation is not so readily made reversible and irreversible with the same power as is the hydraulic type.

Although engineering tests are as yet incomplete and the Isodraulic system not available to the industry, indications are that it will become available at a not very distant date.

Rubber Conservation Report Prepared for Ordnance

The Tank Subcommittee of the Rubber Committee of the SAE War Engineering Board issued its fourth progress report on the reduction of rubber in combat vehicles for Major-Gen. G. M. Barnes of the Ordnance Department about the middle of March.

The members of the group responsible for this report are: C. V. Crockett, Cadillac Motor Car Division, General Motors Corp.; J. H. Doering, Ford Motor Co.; A. J. Kearfott, Research Division, General Motors Corp.; W. M. Phillips, Research Division, General Motors Corp.; R. L. Wheeler, Chrysler Corp.; J. P. Wilson, Ford Motor Co.; R. B. Wuerfel, Chevrolet Motor Division, General Motors Corp.

SECTION ROUND-UP

◆ **BUFFALO** ◆ April 20 meeting was a joint one with American Society of Mechanical Engineers' Buffalo Section.

◆ **CANADIAN** ◆ Three past-presidents graced the speakers' table on May 7—Arch T. Colwell, A. W. Herrington, and R. R. Teetor. Meeting taxed ballroom of Prince Edward Hotel to capacity, with approximately 150 turned away.

◆ **CHICAGO** ◆ Speaker on Navy Night Program, May 11, was Executive Officer and Acting Commanding Officer of the Naval Air Station at Glenview, Ill.—Truman C. Penney, lieutenant commander A-V (G) USNR. Meeting chairmanned by R. D. Edwards.

◆ **CLEVELAND** ◆ SAE Vice-President John G. Lee presented "Engineering Background of the Fighter Airplane," on May 10.

◆ **INDIANA** ◆ Past-chairman Lon R. Smith, Prof. H. M. Jacklin, and R. M. Critchfield were among those present on April 22 to hear E. J. Willis and R. G. Anderson, Aluminum Co. of America, discuss new methods of assaying heat dissipation and stress analysis.

◆ **KANSAS CITY** ◆ "Aircraft Manufacturing Problems," by George A. Arnold, assistant general manager, Commonwealth Aircraft, Inc., presented by Factory Manager Harry Goss, due to Mr. Arnold's inability to attend April 26 meeting. (See "Plane Production Ever-Changing Task," p. 34.)

◆ **METROPOLITAN** ◆ George Freyermuth, technologist for Standard Oil Co. of N. J., illustrated and discussed chemical background and manufacturing applications of petroleum synthetics before a large group of Met Section members and guests at Hotel Edison on April 15. (See "Buna S Duplicates Many Rubber Qualities," p. 37.)

◆ **MID-CONTINENT** ◆ New officers for coming year elected on May 7: chairman, Carl A. Tangner; vice-chairman, W. H. Emmons, secretary, Arch L. Foster; treasurer, John H. Baird.

◆ **NEW ENGLAND** ◆ Chairman John A. Hassey arranged for one of the New England Section's famous broiled lobster dinners preceding technical session on April 15.

◆ **NORTHERN CALIFORNIA** ◆ Three quarters of those who attended April 13 meeting voted for 1943-1944 meetings to be held at Engineers Club. No hands were raised for "no."

Discussion led by Frank W. Kavanagh, Standard Oil Co. of Calif., on "Formation and Control of Piston Ring Deposits," paper presented by George H. Denison, also of Standard Oil, on May 11.

◆ **PHILADELPHIA** ◆ "Driver Training Programs" subject of April meeting, with Amos E. Neyhart, Institute of Public Safety, Pennsylvania State College; Robert I. Gayley, Supplee-Wills-Jones Co., and J. R. Hanna, Atlantic Refining Co., speakers.

◆ **ST. LOUIS** ◆ Lt.-Col. Richard W. Coward pinch-hit for Col. Merle H. Davis, chief of St. Louis Ordnance District, as speaker at April 22 meeting.

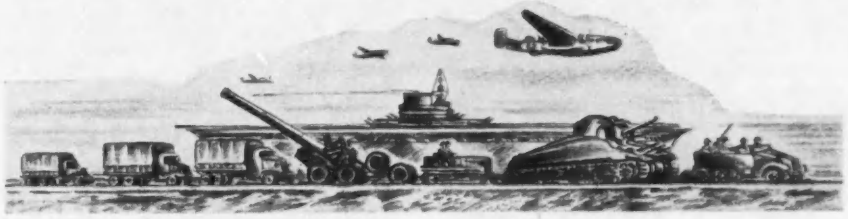
◆ **SOUTHERN CALIFORNIA** ◆ Section played large part in War Production Clinic held at University of Southern California, April 30. Attendance nearly 3000.

May 1 meeting was held at Kaiser steel plant—with dinner at Fuller Ranch. Vice-

SAE WAR MATERIEL MEETING

Book-Cadillac Hotel — Detroit

June 9 and 10



WEDNESDAY, JUNE 9

Morning — Truck and Bus

E. W. Allen, Chairman

Lessons Learned from World War II about Designing for Accessibility

—Col. E. S. Van Deusen, Tank-Automotive Center

Shot Blasting to Increase Fatigue Resistance

—J. O. Almen, General Motors Corp.

Afternoon — Passenger Car

Roy Cole, Chairman

Suspension for Track-Laying Vehicles

—Lt.-Col. Joseph M. Colby, Tank-Automotive Center

Various Types of Tank Engines Compared

—Lt.-Col. R. J. Icks, Engineering Mfg. Branch, Tank-Automotive Center

Evening — Production

Arnold Lenz, Chairman

Progress in Precision—Inspection Methods through the Automotive Age to World War II

—O. J. Snider, Cadillac Motor Car Division, General Motors Corp.

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THURSDAY, JUNE 10

Morning — Passenger Car

John G. Wood, Chairman

Dust Problems in Military Vehicle Operation

—L. F. Overholt, International Harvester Co., Inc.

Substitution of Steel for Aluminum in Brake Cylinder Pistons

—J. F. Bachman, Chrysler Corp.

Afternoon — Truck and Bus

John H. Hunt, Chairman

Looking at the Future through the Eyes of Research

—C. F. Kettering, General Motors Corp.

■ ■

DINNER

SAE Detroit Section, Host
A. G. Herreshoff, Chairman
C. C. Carlton, Toastmaster
Mac Short, President, SAE

Speaker: Rear-Admiral Ralph E. Davison,
Bureau of Aeronautics, U. S. Navy
Subject: The Automotive Industry in Naval Aircraft Production

chairman Wallace Linville ran the party. ODT's Roy Long was presented with a scroll of appreciation for his cooperation with the Society and fleet operators.

◈ SOUTHERN NEW ENGLAND ◈ Wound up season's technical meetings on April 16 with large turnout – dinner group of about 90 members and guests swelled to well over 200 to hear SAE President Mac Short and Charles L. Morris, helicopter test pilot of Vought-Sikorsky Aircraft, and holder of first commercial helicopter pilot license. (See p. 36, "Promising Future for Helicopter.")

◈ TEXAS ◈ SAE Staff Representative J. D. Redding talked on "Aircraft Standards for Victory" (see. April, 1943, *SAE Journal,* beginning p. 20) at May 7 meeting, held as part of big May 3-8 Texas Aviation Conference. Section Chairman Allen Guiberson presided.

◈ WASHINGTON ◈ G-man E. P. Coffey, chief of the technical laboratory, FBI, addressed Washington Section meeting on April 19.

◈ MOHAWK-HUDSON ◈ Program of March 30 illustrated by lantern slides depicting development of modern flying and principles involved in various types of aircraft.

◈ MUSKEGON ◈ March 26 meeting extremely well attended. Heard D. R. Hoover, production engineer, Buick Aviation Engine Plant, analyze problems involved in mass production of high-output aircraft engines for Army-Navy bombers. Everyone hearing Mr. Hoover's talk went away with full assurance that a great job has been, and is being done, by the men at the Buick Aviation Engine Plant, reported Field Editor Douglas W. Hamm – further proof that American ingenuity has no equal the world over.

◈ CALIFORNIA INSTITUTE OF TECHNOLOGY ◈ Elected officers for 1943-1944. They are: chairman, Glynn Lockwood; vice-chairman, Jack Kettler; secretary-treasurer, Douglas Dethlefsen.

Sees Gradual Switch to Electric Remote Controls

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The invention consists of a very simple circuit, which requires a current-type relay. Only one of these relays is necessary for each actuator, as the current-limiting relay operates in both the up and down control circuit. This relay weighs 12 oz and its size is independent of the power or size of motors being controlled.

There is far more to recommend the use of electric remote controls on aircraft. Haven't you had an occasion when you wished you could synchronize the motion of two units electrically, and only had 24 d-c available with which to do it? Maybe you can do it hydraulically, but there are some aircraft manufacturers who are discarding their well-metered hydraulic flap actuators and replacing them with synchronous d-c motor-driven screw jack actuators.

Simple circuit arrangements easily provide insurance against flaps getting out of alignment or synchronism; also, operation is prevented when connectors to one motor are left unconnected due to poor maintenance or inspection. Then it follows that, at last, if we can run two or more motors in synchronism from start to stop, we have the means to provide remote indication accurate to an unbelievable extent, and also a means of remote positioning or selecting.

There are unlimited things that can be done by combining electrical and mechanical units and the airplane of the future, the airplane that wins the war for us, will include many of these electrical gadgets along with as few hydraulic units as it is impractical to eliminate.

W.E.B. Progress Report On Clutch Facings

The fourth progress report on clutch facing materials to be used in military vehicles was recently submitted to the Tank-Automotive Center by the SAE War Engineering Board.

It is evident that the final determination as to the relative merits of the materials should be based on actual road tests, as laboratory results often prove unreliable.

The 13-man Clutch Facing Committee responsible for the work consisted of representatives from both the clutch and the automobile manufacturers, and was headed by Harold Nutt, Borg & Beck Division, Borg-Warner Corp., as chairman.

Aircraft Lends Itself to Hydraulic-Electric Units

continued from page 33

ity of cases be quickly and easily repaired should a failure occur.

In summing up, the following can be said:

- Hydraulic-electric remote control systems can be designed and installed to be as free from gunfire troubles as any other system by utilizing armor plate;
- The weight of such a system, including its share of armor plate, can be no heavier than any other system without armor plate protection;
- Emergency operation can be effected by the crew in case of electrical system failure;
- Precision control of the most accurate degree can be had as a result of making use of the best advantages of both electric and hydraulic systems.
- Electrical control of a hydraulic power system affords the maximum flexibility as regards the various types of aircraft control systems which can be operated by this basic control circuit. Actual investigations have so far revealed no limitations to the different types of automatic systems which can be controlled by the hydraulic-electric remote control.

Therefore, the use of a single basic control system for all types of aircraft control systems, whether they are manually or automatically operated, lends itself exceedingly well to the standardization of such components for a particular aircraft.

General Motors Institute student members heard W. F. Wiley, and H. Heron, both of the Fisher Tank Division, General Motors Corp., at the March 24 dinner meeting

Left to right:

W. R. Hock (back to camera), Speaker W. F. Wiley, who explained the methods and principles involved in armor plate welding, as well as the type of equipment and material used; L. C. Pascoe, general chairman, C. A. Armitage, secretary-treasurer, and W. J. Gorman, Jr., chairman of the Activity Committee

WPB's Wilson Gets More Power In Recent Administrative Changes

REDEFINITION of lines of authority within WPB shows clearly that Chairman Donald M. Nelson meant what he said when he announced that Charles E. Wilson, erstwhile president of General Electric Co., was to be his chief lieutenant.

The administration of the war effort on the home front was tightened by Administrative Order 2-85 (March 19) and more recent ukases.

As **Executive Vice-Chairman of WPB,** Mr. Wilson is in direct control of many basic functions heretofore under the administration of Mr. Nelson.

Several WPB administrative offices report directly to Mr. Wilson, such as Organizational Planning, Budget, Personnel, and Division of Information.

Mr. Wilson is also chairman of the Aircraft Production Board. Reporting directly to him are also Controller of Ships William Francis Gibbs, the famed designer of the Liberty and other production-model ships; Steel Division under Hiland G. Batcheller; Copper Division headed by Harry O. King; and the Aluminum & Magnesium Division under A. H. Bunker.

International Supply Vice-Chairman William L. Batt, a veteran of the National Defense Advisory Commission and OPM executive, reports to Mr. Wilson. Mr. Batt also is responsible for:

- War Production Drive Headquarters under William G. Marshall;
- Labor Production Division under Wendell Lund, and the Combined Production & Resources Board under Arthur B. Newhall.

Vice-Chairman Ralph Cordiner also reports to Mr. Wilson. Under him are the WPB Planning Committee, the Procurement Policy Division, Statistics Division under the veteran Stacy May; Office of Production Research & Development under Dr. Harvey N. Davis; Resources Protection Board under William K. Frank, which works closely with the FBI and military authorities; Facilities Division, which provides facilities for manufacturing and is directed by William B. Murphy; and the Facilities Bureau under Charles E. Volkhardt, charged with new construction programs.

Also serving under Mr. Wilson is the:

Program Vice-Chairman, J. A. Krug. (As director of the Office of War Utilities he also reports to Mr. Nelson.) Under Mr. Krug, as Program Vice-Chairman, are the:

- Requirements Committee, of which he is chairman. This is the top group to determine the requirements of the 17 claimant agencies, including the Army, Navy, Lend-Lease, etc.
- Office of Food Consultant, Lee Marshall, director. This office proposes to render whatever WPB services may be required of the several agencies interested in the nation's food problem.
- Production Controls Bureau, Harold Boeschenstein, director. Reporting to him are the Controlled Materials Plan (CMP) Division, under Walter C. Skuce, and the Production Scheduling Division, in charge of scheduling component parts (CSP), under Harry Zellman, a former General Electric executive.
- Orders & Regulations Bureau, composed of the Appeals Board, headed by A. N. Holcomb, and the Orders & Regulations Branch, which passes on all WPB orders and regulations, and which is charged with reducing the paperwork and coordinating regulations.
- Program Bureau, John F. Fennelly, director. There are five divisions under Mr. Fennelly: Military, which correlates the military requirements; Non-Military, which is charged with compiling all other claimant agency requests; Foreign, whose functions include Lend-Lease data; Stockpiling & Transportation, and Urgency Rating, which recommends higher priority adjustments.
- Distribution Bureau, under SAE Member Byron C. Heacock. His three divisions are the Controller, Canadian Review, and Compliance, which enforces orders and regulations.

Operations Vice-Chairman Donald D. Davis.

- Field Operations are under Deputy Vice-Chairman for Field Operations Wade T. Childress. This office administers the local field offices of WPB.
- Industry Operations are under John Hall. Eleven divisions and offices report to Mr. Childress and his assistant, John P. Gregg. They are: Government, Radio and Radar, Shipbuilding, Concentration including the program of concentration of production, Conservation (see "Conservation Tasks, etc.," p. 23), Mineral Resources Coordinating, Industry Advisory Committees, of which there are nearly 350, Product Assignments which is charged with: Procedures, Redistribution, and the Salvage Division, in charge of nation-wide salvage programs.
- Commodities Bureau, H. D. Huges, director. Five divisions head up under this bureau: Chemicals; Containers; Cork, Asbestos and Fibrous Glass; Printing & Publishing, and Pulp & Paper.
- Construction & Utilities Bureau, headed by James Auten, administers these four divisions: Building Materials, Lumber & Lumber Products, Plumbing & Heating, and Transportation.
- Consumers Goods Bureau, headed by Lewis S. Greenleaf. His five divisions are Tobacco & Tobacco Products; Consumers' Durable Goods; Service Equipment; Textile, Clothing & Leather; and Wholesale & Retail Trade.
- Equipment Bureau, in charge of Harry A. Rapelye, with these six divisions: Automotive, Construction Machinery, Farm Machinery, General Industrial Equipment, Safety & Technical Supplies, and Tools.
- Minerals Bureau under Howard I. Young, administering the work of these five divisions: Mica & Graphite; Mining; Miscellaneous Minerals; Tin & Lead; and Zinc.

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Flexible

Shifts of Men Go on Apace in Factories

Throughout the country production engineering ingenuity is keeping the combined productive plant of the nation flexible. Otherwise, serious cutbacks of orders would disrupt the whole Army, Navy, Lend-Lease and other manufacturing programs.

Examples:

- When recoil mechanisms for cannon were reduced, one plant immediately retooled for airplane landing gear hydraulic units;
- Tank armor plants were retooled to bore engine cylinders on shell lathes;
- Tank manufacturers are now building airframes, using the bulk of their equipment and holding down retooling to a minimum.

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Machinery

Tools Have Reached Peak of War Output

IN a series of orders and official pronouncements, WPB has clearly indicated that the nation has enough manufacturing machinery to beat the Axis.

The recent unprecedented rate of machine tool building, including the huge production of subcontractors and factory tool rooms, has supplied the arms manufacturers with their basic needs, and sharp cutbacks have already been ordered.

The nation has been on a machine tool jag to achieve this situation, and all programs have been studied by special WPB staffs to disclose further possible cutbacks. There is some fear that these proposed cuts will be so severe that maintenance parts may also be restricted from manufacture.

A new Facilities Review Committee of WPB will replace the Facility Clearance Board, established in October, to implement WPB's decisions in respect to new plant and tooling outlays.

Heretofore the Army-Navy Munitions Board has been approving machine tool orders. Now, only those going into a theater of military operation may be so approved, according to WPB.

Again machine tools will be cataloged. These will be kept up to date, and attempts will be made to sell or exchange existing machines.

The Machine Tool Division of WPB is planning to shift war orders from companies with large backlogs to machine tool companies who will be hard hit by this shift in end product need. Scores of meetings have already been held at the invitation of George H. Johnson, director of the division.

Redistribution Of Idle Tools

WPB is attempting to get tools, immobilized at war production plants, back into service. Reasons why tools are not in use:

- Changes in product design,
- Completion of war contracts,
- Over-buying by purchasing agents.

The Industrial Supply Distributors Advisory Committee was told that distributors' stocks would tend to become better balanced through the operation of CMP, which is expected to provide a smoother flow of goods.

One "task" group has been named to study Order L-63 (inventories) and another will study the problem of redistribution of cutting and precision tools lying idle in plants.

Rubber

Highlights of Third Report Given by Jeffers

GOAL of Rubber Director William M. Jeffers, as announced in his third report, is:

5,000,000 new passenger car tires to be built in 1943;

30,000,000 new automobile tires in 1944;

The rated capacity to produce rubber and its components under the current program:

Products	Plants	Units	Tonnage (LT)
Buna S	14	30	735,000
Butyl	3	5	75,000
Neoprene	1	4	40,000
Total Rubbers			850,000
Raw Materials for Buna S:			
Butadiene	23	32	688,500 (ST)
Styrene	7	13	202,500
Total Plants	48	84	

The above represents 79% of the Baruch Committee recommendations, cut back because of scarcity of critical construction and machinery materials.

Details:

- Eight refinery conversions were canceled;
- Capacity for 64,000 short tons of Butyl and 20,000 st of Neoprene have been canceled, because of the need of iso-butylene for aviation gasoline. These types of rubbers are not now needed in the military requirements.
- Approval pending, at last report, of capacity for 109,800 tons butadiene; 33,600 st of styrene, and 104,000 lt of copolymer (Buna S).
- Original estimate of need of Thiokol N of 60,000 tons, reduced to 24,900, after it was found that this material could be used for fewer applications than originally believed.
- Guayule, which grabbed headlines two years ago, has been curtailed because of food program and lack of manpower, and production will be limited. Despite early claims, this plant produces more rapidly and in greater volume on irrigated lands.
- Other natural rubbers are being studied by the Office of Rubber Director. Under the new Rubber Development Corp. of RFC it is promoting development of plantations in Cryptostegia, Haiti; in the Amazon basin, Mexico, Colombia, and Ecuador, as well as less promising areas.

All plants in the synthetic rubber program will be in operation this year.

Stockpile news is good. At the end of 1943 they will be about 42,000 lt higher than was estimated, with an estimated balance at the end of the year of about 142,000 lt.

The 1944 prospects indicate that synthetic plants will produce more than 750,000 lt of crude equivalents, and 74,000 lt of crude imports.

Requirements for 1943 reach 609,000 lt, of which the military estimate is 286,000 lt; trucks, buses, and cars, 136,000 lt; export, including Canadian, 161,000 lt; and other indirect military about 36,000 lt.

Praise was given the military services for conservation, and patience of the public in reducing their requirements and their cooperation in scrap drives. Cooperation of the Standard Oil Co. of N. J. and rubber companies in patent interchange is counted upon by Mr. Jeffers to go far in extending the use of synthetics.

Woodworkers Busy on Army Truck Bodies, Saving Steel

Thousands of small woodworking companies are manufacturing wooden truck bodies for the Tank-Automotive Center, through 73 strategically-located contractors. This program has already saved thousands of tons of steel, and has kept many of these smaller plants busy on war work.

Lumber, obtained through an agency of the Army-Navy Munitions Board, will be allocated to the prime and subcontractors through the Tank-Automotive Center. Contracting for the bodies is being done by the 13 Ordnance Districts of the Ordnance Department.

Colleges, Universities For Training Cadets

A total of 532 colleges and universities have been approved for specialized war training by the Army and Navy, the War Manpower Commission said.

Advanced engineering for the Army will be taught in 103 institutions, and in 51 for the Navy. For all types of specialized military and technical training, the Army has approved 201, the Army Air Forces 158, and the Navy 143.

Total facilities of Cornell University and the University of Kansas will be devoted to the Navy, and those of Carnegie Tech and the University of Missouri will be used by the Army.

Backhanded

Trailer Order Opens Door To Non-Essential Uses

Although Limitation Order L-1-g started out as a conservation expedient, it opens the door for non-essential users of trailers and will be a boon to sundry operators who have been prevented from obtaining new trailers.

As defined in the order (May 10):

- Truck trailer is a complete semi- or full-trailer, or its chassis, but does not include a powered or dead third axle, or a re-assembled truck trailer;
- Re-assembled truck trailer is a complete semi- or full-trailer, produced from used parts, but to which has not been added more than 30% by weight of a similar new vehicle;
- The re-assembled vehicle must show the trade name, model, serial number, load capacity, and "Re-assembles with not more than 30% new iron and steel."

Floating Power

J. A. Krug, director of War Utilities, has inspected the first of four floating powerplants, to be moored near war plants to supplant regular sources. They will be installed on barges, and are expected to produce 35,000 kw each.

They will be assigned by the Office of War Utilities to meet emergencies, recalling the use of a Navy aircraft carrier which was moored several years ago to supply the city of Tacoma temporarily.

Cutbacks

Serious Reductions Ahead, WPB Indicates

WAR Production Board officials are worried at the heavy cutback prospects in armament manufacture.

Billions of dollars of contracts will be involved during the next three months, although the daily rate of expenditures is expected to rise from the $280 million figure (April) to around $350 million by July before leveling off to about that or $325 million.

Reasons for cutback:

- Fluidity of war tactics, requiring new emphasis on new weapons and supplies, and
- Production rates increased in most instances far beyond the estimate of Government or industry.

To date, cutbacks in plant facilities have been the most serious, disrupting large segments of the construction industry.

Ammunition production has outrun estimates, and has threatened material shortages for other needed equipment.

Machine tool cutbacks are looming large. Old line companies, their subcontractors, and tool shops of many large metal working companies have been successively upping their schedules until there is a veritable flood of machine tools flowing from the builders. Slashes in new facilities mean huge reductions in projected tooling programs.

The check, resulting in cutbacks, has come from the materials shortages and not from reduced appropriations, or any worry that Congress has become cost-conscious.

Industrial representatives are trying to get advance information on new needs to warn their factories of projected changes by the Army and Navy in time to prevent serious dislocations of skilled labor back home.

Convoy Plane Carrier Was Auto Man's Idea

An automotive engineer, who must remain anonymous for the present, conceived the idea of the "inverted derby hat," or the "Woolworth" aircraft carrier, now in large production in the United States and Great Britain.

These craft, with a standard Liberty freighter hull, are used to escort convoys, and are said by the British Admiralty to be the answer to enemy submarine packs.

Alien Concerns Go Under U. S. Hammer

First group of alien firms to be auctioned by the Alien Property Custodian total 285 German, Japanese and Italian concerns, with a conservative estimated value of $1½ billion. Details are being studied to prevent early return to their respective companies.

Among the larger concerns are American Bosch Corp., General Aniline Film Corp., and Buffalo Electric Chemical Corp.

Plane Output

Huge Increases Reported On Weight Basis by U. S.

WITH aircraft production being currently reported on a weight basis rather than by units of unspecified size, a more realistic picture of output has been made available by the President.

YEAR	POUNDS OF AIRCRAFT
1944	1,417,000,000 (est.)
1943	911,000,000 (est.)
1942	291,000,000
1941	87,000,000

These increments from 1941 of 3½:1 in 1942, 10½:1 in 1943, and about 16 1/5:1 for 1944 (est.) indicate the herculean task of all American industries which will participate in this program.

Engine production, in terms of horsepower, has been called upon to increase more rapidly because:

- Speedier performance is being required, and
- United Nations' military leaders are increasing orders of spare engines and spare parts.

This has been accomplished with smaller ratios of plant and equipment than was originally projected by the military services and WPB (see "Aero Plants 10:1," p. 24).

U. S. airplane production exceeds that of all other nations combined, the President said on May 11.

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A.S.T.M. Standards

1942 Edition, in Three Parts, Just Issued

The 1942 Book of Standards has just been issued by the American Society for Testing Materials, 260 South Broad Street, Philadelphia. It is published in three parts, and assumes special significance in view of new war emergency specifications.

Published triennially, with annual supplements to each part, the 1942 edition contains 1090 standards and has 4900 pages, or an increase of 224 standards and 1200 pages over the 1939 issue.

Part I, Metals: 361 specifications and tests, covering 1690 pages.

Part II, Nonmetallic Materials, Constructional: 425 specifications and tests.

Part III, Nonmetallic Materials, General.

Cost of each part is $9, supplements, $3 for each part each year.

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WPB Management-Labor Council Named by Nelson

An eight-man Management-Labor Council to bring both groups more intimately and effectively into the war Program has been named by Donald M. Nelson, who met on April 2 with the new group.

They will meet periodically.

Members:

Frederick C. Crawford, president, National Manufacturers Association, who is president of Thompson Products, Inc., and an SAE member.

William Green, president, American Federation of Labor.

Eric Johnson, president, Chamber of Commerce of the U. S.

Philip Murray, president, Congress of Industrial Organizations.

Industry Men to Break Bottlenecks

Special industry committees, dubbed "task forces" by WPB Chairman Donald M. Nelson, will be organized to advise on methods of breaking production bottlenecks. The production troubles will be analyzed from the standpoint of critical component parts, and the committees will be asked for specific recommendations to cope with the problems as they arise.

Engineers Face New Plan of Component Scheduling

continued from page 23

blowers and exhausters, steam condensers, turbines, turbo generators, motor generator sets, heat exchangers, pressure vessels, pumps, stokers, pulverizers, transformers, fans and blowers, and switch gears.

These are control components when, and only when, they are purchased directly from the manufacturer by the prime contractor or claimant agency which is building the product or project into which the component will go. When purchased by others, these items are sub-components.

Sub-components, as well as including the above items when purchased by persons other than prime consumers and claimant agencies, include:

Crankshafts, fuel injectors, carburetors, magnetos, reduction gears, electric motors, electric motor controls, and generators.

These are sub-components regardless of who purchases them.

WPB officials expect to broaden the above scope of its operations as soon as possible.

Form PD-903

Implementation of the Plan: The plan is implemented through Form PD-903 which is the responsibility of the claimant agency.

When the Army, for example, programs a model of tank for construction, it must supply the appropriate Industry Divisions of the War Production Board with a copy of PD-903 covering orders for components for orders placed after June 1.

The form requires the following information:

Name and address of the company upon whom the form is served (company requested to execute the form by the claimant agency),

Name of the claimant agency responsible for the program or project into which the component will go,

Government contract number,

Name of the company placing the order,

Application or use of the component,

Specifications of the component, and

A 24 months' projection of the required delivery schedule, together with the manufacturer's actual as well as promised delivery schedules.

PD-903 serves as a "screening" form; a means of identifying components, by programs; a means of scheduling required deliveries, a means of reporting actual shipments, and finally, a means of reporting order boards (proposed delivery schedules) to Industry Divisions of WPB.

One PD-903 as compiled for a claimant agency may contain no more than one class of control component to be ordered from no more than one manufacturer. However, several control components of the same class, to be produced by one manufacturer for use in several programs of one claimant agency, may be included in on PD-903.

Claimant agencies and manufacturers are expected to program for several months into the future. PD-903 makes provision for a 24 months' projection.

Upon receipt of a PD-903, the Industry Division of WPB will compare it with a manufacturer's existing schedules of deliveries, and make whatever adjustments may be necessary before returning it to the claimant agency. Adjustments may call for relocation of orders among plants producing the same component in order to obtain maximum effective use of facilities.

The claimant agency may, as a result of the Industry Division's adjustments, be required to reduce its programs because of inability to secure needed amounts of components. When all necessary adjustments have been made, the claimant agency sends the PD-903 to the prime contractor, who in turn sends it to the control component manufacturer.

If instructed to do so by the prime contractor, the control component manufacturer will return the PD-903, after having indicated his promised delivery schedule against the required delivery schedule which has been presented to him. If in order to produce the control component the prime contractor purchases one or more sub-components from other manufacturers, he will obtain their promised delivery schedules before indicating his promised delivery schedule for the control component.

Upon receiving a PD-903 on which a control component manufacturer has indicated his promised delivery schedule, the prime contractor must return it to the claimant agency unless instructed to the contrary.

All persons in a contracting chain who use components in any form must present the person from whom they are purchasing components with a PD-903, indicating the required delivery schedule, together with identification of the program into which the component will go.

If any manufacturer in the contracting chain is unable to promise a delivery corresponding to the required delivery schedule indicated on the PD-903 which he receives, his customer must report the situation to the appropriate Industry Division of WPB in order that appropriate action may be taken.

It is also significant that under the procedure as established, claimant agencies may assume the responsibility of prime contractors by informing component suppliers of certain prime contractors of required delivery schedules. This will be done by claimant agencies on PD-903. It will mean that the Army or Navy, for example, will no longer be able to use expediters below the first component supplier level, whenever this procedure is adopted.

Economic Aspects of Standardization

continued from page 22

the WCAB, and issued as NAS sheets 144 to 158 inclusive. Again the benefits of standardization in cost reduction are strikingly illustrated by this case. Prior to the standardization, bolt manufacturers considered aircraft internal wrenching bolts special and, as an example, the cost of a ½ x 20 bolt was $1.30. After the establishment of the NAS standard, the bolt manufacturers prepared the necessary tooling so that the same bolt could be purchased for 34¢, constituting a cost reduction of 74%. On a recent single order for some 5000 of these bolts, a saving of over $4800 was realized through use of the NAS 148 standard.

Surface finish designation – One of the most interesting projects assigned during the year was that for the preparation of a surface-finish specification. Vega was made responsible for this project and coordinated its work with the SAE and the American Standards Association. The issuance of the resulting standard sheets NAS 30 and 31 mark an important forward step. No longer is it necessary to use qualitative terms such as lapped, ground, smooth, or rough machine in designating the character of finish required. The basic research and developments which made this project possible were carried on by the Chrysler Corp. in connection with its development of "Superfinish," a project of the highest significance and interest where precision work is required.

Extrusions – Reference has been made to a major project on the standardization of extrusions assigned to the Martin Company. In this work, they considered 1878 extruded sections and found from the nation-wide survey of the airframe manufacturers that 25% of these had a usage of less than 1 ft per airplane, being employed primarily for clips and brackets. It was also found that many sections were essentially duplicates of each other, the differences being negligible. Their analysis brought out the fact that in the various classes of extrusions there was quite an uneven distribution according to area, there being many cases with small area differences between similar sections; and again there were large gaps in the series. This was due to lack of coordinated planning. The finally approved standards given on NAS sheets 130 to 135 inclusive give a well-coordinated series of commonly used structural shapes, such as plain and bulb angles, channels, and tees.

Aircraft screws – A project involving unusual difficulties and of considerable importance was that regarding aircraft screws. This was assigned to Lockheed. Because of the many variables of head type, material, and thread length, this project was not a simple one. Investigation revealed that there were 13 different basic types of screw heads used by the aircraft industry:

100-deg Flush	100-deg Oval	Brazier	Binding
82-deg Flush	82-deg Oval	Round	Washer
78-deg Flush	78-deg Oval	Button	Truss
			Fillister

Aerodynamic, strength, and production considerations as regards screw manufacturing entered into the problem. The brazier head, the round head, and the 100-deg countersunk head were those finally selected. A basic decision had to be made in connection with the method for driving screws, namely, whether the head was to be slotted or recessed. The decision as finally approved led to the elimination of the slotted head. What appeared to be a relatively easy problem, namely the selection of thread length, proved to be the most difficult one because of the numerous conditions that had to be met. The failure of previous standard screws to meet these conditions had been a source of continual and, at times, serious trouble.

As part of the project a graph was devised so that when the nominal total thickness of the material through which the screw passes is known, the correct length of screw can be determined. The thread lengths chosen for standardization were such that when screws are selected by means of this chart, the four basic criteria relating to thread length are met. The results of this project are given on NAS sheets 200 to 235 inclusive.

Some idea of the economic benefits of this project, both to the airframe and screw manufacturers, may be had by noting that prior to the completion of this work Lockheed was stocking 1688 sizes of screws which came directly within the scope of the project. After its completion it was found possible to reduce the stock carried to 576 NAS screws, eliminating a total of 1112. Further note will be made of the effects of such reductions in stock items on our company's overhead. We have been advised by the American Screw Co., one of the largest screw manufacturers, that this project will result in production savings to that company of 10-15%, and that, in their opinion, this work of the NASC was the most constructive move that has been made to increase the contribution of the screw industries to the war program.

Work of Electrical Subcommittee – The final accomplishment of the NASC in 1942 selected for comment is the work done by the Subcommittee on Electrical Installations, the responsibility for which was given to the Douglas Aircraft Co. As a result of the activity of this subcommittee, on which were represented several airframe manufacturers, an electric bonding specification was prepared and approved by all NASC members and is now awaiting approval of the WCAB.

Another result of this committee's work has been the standardization of electrical wiring diagram symbols reflected on NAS sheet 71. One of the extremely troublesome service problems experienced in the field and combat areas has been that of identifying electrical circuits at points where conductors have been severed by bullets or accident. The Materiel Center insisted that an answer be found. Solution of the controversial problem fell to the lot of the Electrical Subcommittee. Finally, instead of securing identification by means of a most complicated system of color coding conductors, the subcommittee fostered the development of a simple marking machine which provides a ready means for numbering circuits as these are made up in the factory. This project has not been finally approved.

Another important activity of this subcommittee, now being concluded, is the problem assigned by the chairman to the Lockheed Aircraft Corp. for standardization of electrical terminals. This standardization provides for terminals mechanically attached to conductors, and through cooperation of three terminal manufacturers, one set of

tools may be used for the assembly of terminals from any one of these vendors.

Current projects – Mention has been made of several NASC projects not yet formally completed. It is of interest to note a few of the other more important projects now under way. Boeing has been assigned one for the development of spacers made from rolled strip material in order to conserve tubing. Two have been assigned to the Douglas Aircraft Co., one on the location of flight controls and one on the standardization of synthetic or plastic low-pressure plumbing fittings.

North American has undertaken the standardization of detail units in aircraft hydraulic systems, this project being coordinated with the SAE Hydraulics Subcommittee. To Lockheed has been assigned the project for standardization of pilots' seats, and to the Wichita branch of the Boeing Aircraft Co. has been assigned the long-range project for the standardization of rolled strip shapes. This project is not to be confused with the immediate program for the substitution of rolled shapes for extrusions.

New Fields for Standardization

The remainder of this paper deals more particularly with an extension of the standardization principle to activities that have not so far received national recognition. Further quantitative examples are given to emphasize to aircraft executives the direct and very great savings already brought about by standardization. It is hoped to indicate ways in which, with some additional effort devoted to standardization, much greater savings can be achieved by a reduction in overhead costs, which bulk so large with our complex, expanded manufacturing organizations, yet which, because they are "hidden costs," are accepted as inevitable, or at least are not carefully scrutinized. In addition, there are certain ways in which it is felt that our standards groups can be of direct assistance to production.

Direct production aides – As an interesting example of the latter effort may be noted the project to standardize on tubular engine mount rings and to provide for their fabrication for the entire industry by a few outside vendors. The present methods for the manufacture of rings within the aircraft plants result in a considerable waste of irreplaceable chrome-molybdenum tubing because of the necessity for holding the tubing while it is being formed into a ring.

It is proposed to do this forming in continuous coils which are cut and made into separate rings by electric flash butt welding. Through the use of electric flash welding, random lengths of tubing can be joined together before coiling, thereby eliminating all waste. It is estimated that at least 40,000 lb of tubing would be saved, a considerable amount of fabricating work removed from the plants of the airframe manufacturers, and a superior product produced at considerably less cost than by present methods. This proposal has been supported by the Western Aircraft War Production Council and definitely approved by several of the member companies.

Another interesting proposal is that the facilities for hot rolling steel bar which now exist in Southern California be utilized to make readily available to airframe manufacturers various smaller sizes of steel bar, the procurement of which from the East requires many months. The NASC would standardize on a series of smaller sizes, which the rolling mill could hot roll from large bars obtained from the East, and stock these standard sizes in a central warehouse from which they could be procured in a few days.

Scientific Method and Standardization

The essence of the scientific method that has resulted in the brilliant accomplishments of science and engineering comprises four steps:

1. The collection or classification of data.
2. The discarding of non-pertinent data.
3. The correlation and comparison of pertinent data.
4. The drawing of sound conclusions.

These simple and basic principles, it is felt, apply directly to standards work. It is believed that our standardization activities have often been too narrowly conceived in that the principles of standardization are not generally applied until parts are ready for formal standardization. It should be emphasized that reference is not made to parts which are in a state of rapid change due to research or intense design development, but for which time and effort are not immediately available for such formal work, especially on a national basis.

Standardization may be likened to the ever-widening circles made when a stone is thrown into a quiet lake. Standardization usually occurs in several steps: starting within a given company, then spreading to a region, to a nation, and finally becoming worldwide. As a rule, before formal standardization can occur, a great amount of information must be obtained and work done following the four scientific principles given above. With the conviction that these principles are sound engineering, the writer for years has advocated the preparation of various types of what may be termed "catalogs," by which is meant an orderly arrangement and classification of similar items.

For convenience, parts susceptible to such treatment can be divided into five classes:

1. "Raw or semi-fabricated materials." Specifications determining the composition and general characteristics of these materials are being prepared by the SAE, and dimensional standards governing the sizes are being prepared by the NASC.

2. The majority of the work of the NASC dealing with parts has been concentrated on what may be termed "element standards," which are simple parts, generally one piece, and typified by bolts, screws, nuts, rivets, and washers.

3. What may be called "purchased parts" are simple assemblies or the more complex single-piece parts, such as plumbing and electrical fittings, bearings, hose, fuses, clamps, and clips. The majority of these are vendor standards, but not Government or industry standards.

4. The term "purchased equipment" is used to denote more or less complex assemblies or units generally designed and produced by vendors, such as seats, valves, shock struts, radio units, and switches. As a rule these are of a standard nature and suitable for use in a number of different airplanes.

5. The term "design standards" may be applied to parts normally designed and fabricated or directly subcontracted by airframe manufacturers. Much engineering time and expensive tooling are required for many of these parts, and yet, even within a company, only too often little effort is made to utilize from one model to another parts of this nature, examples of which are gear boxes, lavatory equipment, various control assemblies, seats of different types, and even many forgings and castings.

Purchased parts catalog – Attention is directed to the third class of parts, namely purchased parts, since these are multitudinous in nature and for this reason offer many difficulties in securing adequate control. To bring order out of a somewhat chaotic condition, the Lockheed Aircraft Corp., a year and a half ago, started a "purchased parts catalog." During the preparation of the catalog, it was found that approximately 13,000 separate parts which were currently stocked were involved. At the present time these have been reduced to 4000, without any material sacrifice in design flexibility, and frequently with an improvement in quality of the items, due to the elimination of more or less unsuitable or low-quality parts.

This catalog comprises 113 separate major classes of items. During the course of preparation, obsolete and inactive parts were discarded, permitting these items to be taken out of stock and disposed of. In a similar manner, parts ordered by error or by designers prior to finalization of design "just to have them on hand" were eliminated. This rough standardization was done as the work progressed.

The next step, which is now in an advanced stage, is that of reducing the number of parts to the minimum possible with the existing design of part. The final step is a further reduction based on a revision of a part resulting from a careful standardization study. A few quantitative examples of this process are given below.

	Number of Items			
Part Description	Original (Uncontrolled)	Required (Orderly Listing)	Optimum (Present Standard)	Optimum (Redesigned Standard)
Stop Nuts	570	450	378	...
Bearings	400	120	...	...
Plumbing Fittings	1500	500	...	...
Bonding Jumpers	...	...	46 Lengths	17 Lengths
Hose Clamps	110	76	22	10
Hose (ID's and Cut Lengths)	...	99	...	13

For each item are given the data necessary for its procurement and selection for design use. This is illustrated by the information relating to a single item.

Bearing – Open Type – Extra-Light Duty

	Dimensions			Static Capacity Non-Brinell		
Code No.	Bore	Diameter	Width	Radial	Thrust	Part No.
2200290	0.875	1.312	0.281	2300	1850	B540[1]

[1] To be purchased from: Fafnir Bearing Co., New Britain, Conn.; Norma-Hoffmann Bearing Corp., Stamford, Conn.; Federal Bearing Co., Inc., Poughkeepsie, N. Y.

The information given regarding similar parts enables the purchasing department to know which parts are equivalent and interchangeable, thus facilitating procurement. On the other hand, it affords the engineering department control of quality by eliminating products deemed unsuitable or inferior.

Attention is directed to the company code number since this is an important part of the mechanism for control. All purchased parts are assigned either a two or three million number. Since no parts can be purchased without a code number and since the assignment of these is under the control of the standards group, it is no longer possible for design personnel to bring about an uncontrolled expansion of these parts. When it is determined that a part is obsolete or to be superseded, it is assigned a six million code number which automatically prevents its being ordered, and requires stores to take the item out of active stock and dispose of it.

The assistance which such a catalog affords to a designer is evident, but it is felt that a greater value lies in its use as a coordinating means between the engineering and production departments and in its direct use by the various production departments responsible for stocking, material control, production planning, and procurement. These catalogs are used by 23 such departments at Lockheed.

Reduction in overhead costs – Several of the aims of standardization are well recognized, namely reduction in cost of a product, facilitating its procurement by simplifying its manufacture, improving the quality of a product by concentration on the details of design, and by improved tooling and processing. Another aim not so generally understood, but from an economic point of view fully as important, is the reduction in overhead in purchasing, stores, production packaging, and general production records that may be achieved by the elimination of thousands of unnecessary items from our stockrooms.

It is estimated that the cost of stocking a single small item, together with all of the records necessary for maintaining inventory control and procurement, runs from $75 to $100 a year, depending on the methods employed. The significance of this is brought out by calculating the possible reduction in overhead through the complete elimination of the 1112 separate screw items from the Lockheed storerooms as previously discussed, in addition to the elimination of approximately 9000 other items by means of the purchased parts catalog. The intelligent and alert activity of a standards group can make a difference of hundreds of thousands of dollars a year in a company's overhead.

Improved control of parts – A further important aim of standardization suggested above, but it is felt not generally appreciated, is that of the control of thousands of miscellaneous parts in the engineering, purchasing, inventory, and production departments through the means afforded by such a mechanism as a purchased parts catalog with its code designations. It may appear that this matter has been unduly stressed, but its importance is due to the complex nature of modern airplanes and the present scale of production, which combine to bring about cost and control difficulties that may not be fully realized.

Purchased equipment – Brief reference is made to a catalog including the fourth category of parts, namely "purchased equipment," those numerous and complex assemblies of widely varying nature produced by vendors. While such items do not lend themselves so readily to classification and cataloging as "purchased parts," the Lockheed Aircraft Corp. is giving serious consideration to the preparation of a purchased equipment catalog.

The benefits to be derived, although less important because only some 1200 items are involved, are similar to those derived from the purchased parts catalog, namely, a source of ready reference for engineering, production, and purchasing, and a means for bringing about an elimination of inactive or obsolete items and a certain degree of standardization.

At a recent meeting of the NASC with the Working Committee of the Aeronautical Board, Lt.-Com. A. M. Blamphin stated that a great gain could be derived from standardization of major rather than minor items. It is

understood that he had in mind parts designed by airframe manufacturers. Although the difficulties inherent in standardization of such parts among companies are great, it is possible, and the resulting gains are commensurate with the effort.

A typical example is a military control wheel, complete with switches, which was standardized and adopted for use by several of the leading aircraft companies. Prior to standardization, the unit price of this wheel was $24.00, a cost which was reduced by 67%, to $8.00, after standardization.

Over a year and a half ago, the Lockheed Aircraft Corp. prepared a design standards catalog covering a wide variety of assemblies designed and fabricated within the company. Initially, the purpose of this catalog was to furnish designers on new projects with a convenient source of reference to previous design work so as to obviate the necessity for re-engineering and re-tooling many items which were in existence and had proved satisfactory. In many instances, because of lack of such a reference, engineers would create a new design, and it was difficult for supervisors to control this human tendency because they too were often unfamiliar with past work.

A catalog of this type has been discussed by the NASC, and certain companies have favored the idea. With several companies in a limited area cooperating in exchange of design catalogs, the benefits are proportionately greater and a real foundation is laid for worthwhile standardization.

Many items are of such a nature that under such circumstances they can be economically tooled by a vendor and the price lowered because of the wider distribution. It is believed that this furnishes a practical way to carry out Com. Blamphin's suggestion.

In standardization work, it is often possible to choose a less expensive part to perform a given function. Our industry has tended to use only the highest quality products available instead of exercising discrimination. The critical procurement situation has compelled us, during the past year, to re-examine many cases and go to a less expensive part which, from the point of view of actual service, generally is quite as satisfactory as our original choice.

With large production of aircraft, particularly in the post-war era, it should be an important part of standards work to determine the least expensive part that will satisfactorily perform a given function. Two or three examples are given below of changes of this nature that have recently been put into effect at Lockheed, with very large savings accruing to the Government.

The first of these relates to the change from a Series I to a Series II or III bearing in different applications on our various contracts. It is to be noted that the unit saving is comparatively small but, because of the great number of applications, the total is large.

Anti-Friction Bearing Conversion

Item	From	To	Unit Saving	Quantity Used	Total Saving
Rod Ends	REB 3N	HEIM F34-14	$0.10	44,300	$4,430.00
Pulleys	Series I Bearing	Series II	0.18	703,100	126,400.00
Needle Bearings	Type A	Type B	....	.....	7,200.00
Ball Bearings	Series I	Series II and III	0.34	188,700	64,100.00
Bearings	Series I	Series II	0.13	234,100	31,100.00
Fairlead Rollers	Series I	Series III	0.23	207,900	48,100.00
				Total	$281,300.00

The next illustration has to do with the choice between two types of cowl fasteners. Here again the unit saving is small, but the total, covering one contract only, is significant.

Cowl Fasteners

	Type A	Type B	Type A	Type B
Size, in.	1⅜	1⅜	1	1
Number per airplane	664	664	60	60
Cost per fastener	$0.161	$0.086	$0.234	$0.080
Installation cost per fastener	$0.124	$0.06	$0.124	$0.060
Total cost	$0.285	$0.146	$0.358	$0.140
Saving per fastener	.....	$0.139	$0.218	$0.218
			Total	$237,100.00

The third example has to do with the substitution of one type of lock nut for another. Here again, the saving on a single contract is very great, considering the nature of the part. Only 20% of the total lock nuts have been converted to date out of a possible conversion of 35%.

Lock Nuts: Cost Reduction* by Substitution of Type A for Type B Anchor Nuts (All Classes)

Type	Simple Hex	Plain Steel or Aluminum Alloy	Plain Steel** or Aluminum Alloy	Corrosion Resistant Steel for Projection Welding	Total
Number	695	873	72	682	2322
Saving per Nut	$0.013	$0.030	$0.136	$0.119	$0.046 (average)

Total Saving for One Contract $239,600

* Includes saving through use of sheet metal screws, possible with substitute nut.

** Difference is due to clip type of substitute in certain applications, which eliminates rivets at a unit saving of $0.05.

■ Conclusion

In concluding this paper, the writer would like to express certain views based on his observation of standards work. Successful standardization calls for vision and imagination to see clearly the problems in their larger and long-term effects on our production. It demands a breadth of view and a statesmanship approach which submerges short-range selfish interests. It requires sound engineering thinking, which considers all aspects of a problem and results in correct decisions. Standards engineers have been given ever-increasing responsibilities and, on the whole, have met their challenge well.

Perhaps the major intent of this paper will have failed if sufficient emphasis has not been given to the large and tangible gains from standardization that are now realities, to win for the standards engineers in their own organization the vigorous and tangible support of our major engineering and production executives.

That the major benefits to our war program and to post-war industry, inherent in intelligent and aggressive standardization, may be secured, these executives must furnish leadership and make available for standards work, where it is advisable, a larger number of high-caliber men. Prompt and effective cooperation should be afforded the standards groups in carrying out the broad Government directives made necessary by our war program. There would be no need to urge this point if we had a clearer realization of the practical and vital way in which, under present circumstances, the decisions and work of our standards engineers are affecting so vitally the present engineering and production programs of our companies.

APPLICATIONS Received

The applications for membership received between April 10, 1943, and May 10, 1943, are listed below. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

Baltimore Section: Arthur G. Moran.

Buffalo Section: Wilmer E. Goode, John L. Drew.

Canadian Section: Arthur David Harris, Paul Gilbert Jefferies, George Ernest Robertson.

Chicago Section: Henry Bjelland, David Chrispens, Jr., Wayne J. Faust, Robert E. Kunkler, Marvin G. Nelsen, Robert M. Nichols, Lester L. Robinson, A. J. St. George, Frank W. Sauger, Oscar H. Theleen.

Cleveland Section: Russell G. Anderson, Howard F. Calvert, Robert Martin Davis, Robert M. Kintz, Robert Ralph Sanker, Samuel Stanford Manson, Robert D. Peter, Jr., John H. Seaton, Bruce M. Sheffer, Chester J. Smitko, Raymond M. Standahar, John E. Tereschuk.

Detroit Section: Charles B. Buker, Henry W. Cooper, Theodore G. Coyle, Richard F. Eberline, D. Emerman, Robert F. Flood, Ted J. Flowers, James Harold Foote, Jr., Clesson W. Genson, Jack Charles Gordon, Robert June, Robert Hall Loughran, Donald W. Main, Donald H. McIver, F. J. Norton, David Ayars Stoddart, Joseph Charles Sutton, A. G. Tsongas, G. E. Winters.

Indiana Section: Robert R. Allen, Albert C. Bell, Albert E. Burch, L. Eugene Easley, Vincent Shannon, Oliver P. Smith, Jr., Atchison B. Tincher, Robert Maxwell Williams.

Kansas City Section: Edgar F. Nason.

Metropolitan Section: W. A. Bennett, Lewis A. Bondon, Raymond R. Davis, Samuel S. Fink, Earl B. French, Ivan B. Friedman, Josef Karl Hoenig, Harold E. Hoben, Rudolph J. Klimkiewisz, Theodore Frank Kuzyn, Henry Wai Foon Lee, George M. McNulty, Giles W. Painter, John G. Pepe, C. Milton Rice, Marshall Sangster, Murray M. Scott, Leon K. Shanack, Harry Morefield Smith, Robert K. Tiedeman, John F. Weidner, John G. Whitehead, Charles S. Van Sickle, Fenton W. Varney.

Mid-Continent Section: Robert Eugene Radford.

Milwaukee Section: Frank Adams, Joseph Frank Barthlemess, Frederick Claude Frei, George W. Mork, Daniel F. Semlak, Glen Allen Spraker.

Mohawk-Hudson Group: Francis X. Gruber.

New England Section: Richard Philip Arms, Grant C. Ehrlich, Johannes Almon Heyliger, Edward William Reardon.

Northern California Section: Edward Connelly, L. J. DeSaules, Lawrence J. Souther, Lt. William H. Wicks.

Northwest Section: Frank William Disch, John I. Florey, C. Edwin Johnston, Howard Platt, Edward C. Wells.

Oregon Section: Vern W. Bailey, Major Clyde L. Falls.

Peoria Group: Erwin John Herman Bentz.

Philadelphia Section: Francis J. Borowsky, T. C. Kuchler, Robert B. Lynch.

Southern California Section: H. C. Akerbert, W. S. Bradfield, Shirley Edson Brush, M. J. Charles, Timothy E. Colvin, Robert L. Day, Robert Chalmers Gross, Harold Millard Harrison, William R. Humes, William Powell Lear, G. Russell Noble, Frank Radovich, Lauren E. Rampton, Parker Keith Remkus, Rohr Aircraft Corp., Arthur Schlosser, Dean Robert Thomas, George Winston Wallace, James G. Woodruff.

Southern New England Section: John Donald MacCarthy, Theodore M. Matson, Edwin L. Rush.

Southern Ohio Section: Dr. Anson Hayes, Clark Prudhon, C. William Viets.

Syracuse Section: Frank T. Christian, Clifford L. Reals, Norman Voelkel.

Texas Section: Roy T. Holmes, Oscar Neil Thompson, J. E. White, Jr.

Washington Section: Philip Edward Banfield, Lucien Warner Bingham, William C. Howard, Afton D. Puckett, Hansford B. Truslow, John Ernest Ziccarello.

Wichita Section: William F. Wright.

Outside of Section Territory: Willis Merle Carter, Capt. Louis M. Dessaint, Ralph H. Everman, James B. Fretz, George Henry Gibbs, Edward Hammermaster, Christian T. Leander, Neil R. McLeod, Lt. Cloyd B. Sayler, Lawrence A. Smith, Milford D. Stewart, D. E. Yates.

Foreign: Mohamed Sharker Mohideen (Ceylon).

NEW MEMBERS Qualified

These applicants who have qualified for admission to the Society have been welcomed into membership between April 10, 1943, and May 10, 1943.

The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (SM) Service Member; (FM) Foreign Member.

Baltimore Section: John T. Ryan (A).

Buffalo Section: John D. Amoroso (M), Alson J. Covel (J), Frank Doddridge Meredith (J).

Canadian Section: George A. C. Bear (A), Percy Edgar Elcombe (A), George K. Elliott (A), Denis Clement Gaskin (A), Karl William Kidd (A), Frederick James Orr (A), C. E. Prefontaine (A), George L. Ursaki (A), Harold A. Washington (M), Horace Wilkes (A).

Chicago Section: James B. Black (J), Warren C. Conover (M), Robert P. French (J), Frank W. Haase (M), Rossall J. Johnson (J), William Austin Kelly (J), William E. Kelsey (J), W. J. Kings (J), John Krawetz (M), Benson Melven Larrick (M), Aubrey L. Whittemore (A), Wesley Wilson (M).

Cleveland Section: Robert Carl Austin (J), Donald LeRoy Christofel (J), Frank DeMarinis (J), James Donald Hill (A), Norbert W. Horn (J), Robert Jardine (M), Hilton J. Lafaye, Jr. (J), Rudolph Lisch (M), James Whiting Maples (FM), Donald H. Martin (J), Stoddard B. Martin (A), Albert C. May (M), Robert W. Mowery (A), Gomer H. Redmond (J), B. P. Resseger (M), Raymond A. St. John (A), Karl Scheucher (J), Seiberling Rubber Co. (Aff.) Reps: Everett H. Gibbs, Wm. J. Ruscoe. James Edward Trainer (M), Joseph L. Varga (J), Robert G. Wingerter (J), George T. Wright (A).

Detroit Section: Joseph F. Bachman (M), Asa W. Bonner (M), D. A. Boyd (M), Ralph A. Braik (A), Bruce B. Bunting (J), J. F. Campbell (M), J. Douglas Caton (M), Wilfred J. Chick (A), Charles Thomas Collins (A), John D. Crary (A), Richard H. Dickenshied (J), Paul J. Dooley (A), Henry D. Eisengrein (A), H. W. Gilfillan (J), Henry J. Gilmartin (A), Lawrence B. Greenbury (A), Alfred H. Haberstump (M), Clarence A. Hall (J), Basil Balfour Henderson (FM), Willard L. Huppen (M), John E. Johnson (A), John A. Kany (J), James H. Marks (M), Mitchell Marvicsin (A), Victor Edw. Matulaitis (M), William Arthur McConnell (J), Arthur L. McDonald (M), Louis N. Murphy (M), Albert F. Myers (M), Nicholas A. Noreyko (J), Elmer Olson (M), Donald C. Perkins (M), Charles P. Pinardi (M), 1st Lt. Frank E. Ream (SM), William F. Robinson, Jr. (J), Capt. James Joseph Robson (SM), Ferd J. Schwamb (SM), Frank K. Seydler (A), G. H. Thomas (A), Henry B. Thomson (M), Toledo Industrial Rubber Co. (Aff.) Reps: Cloyd L. Bugert, Louis F. Gongwer. Alex R. Nazar. Augustus S. Wade (A), Frederic Weyburne (A), Walter F. Wright (A).

Indiana Section: Harold H. Clayton (M), William A. Cost (M), Robert A. Daily (M), Dallas F. Lunsford (M), Raymond James Maci (J), Clarence M. Wetzel (M).

Kansas City Section: Mustafa A. Akinci (J).

Metropolitan Section: Cornelius James Abbott (A), Peter Abruzzo (J), Henry M. Atwood (A), O. G. Burford (A), W. H. Bush (A), Ernest Augustus Crawford (M).

Francis P. Duffy (J), Louis L. Fragala (A), Robert O. Froling (J), Gordon Wright Hickenlooper (J), J. Henry Hickman (A), Robert Nelson Juntwait (J), Edwin C. Kirk (A), Robert Lee LaFollette (J), Donald C. McMacken (M), William J. O'Donnell (M), Donald Edward Platz (J), Lt. Fred N. Potter (J), T. G. Roehner (M), Donald J. Ronayne (J), Kurtiss P. Schenke (A), William C. Schulte (M), James J. Shanley (M), Leo John Shannon (J), Ernest G. Smith (A), Samuel Thomas Stafford (A), Wallace M. Stanton (M), Adrien T. von Schmid (M), Harold H. Warden (M), John W. Willie, Jr. (A).

Mid-Continent Section: Harold Millard Trimble (M).

Milwaukee Section: Henry H. Erkenz (M), George J. Haislmaier (M), Fred S. Mackey (M), Raymond A. Nevshemal (M), William J. Schlapman (J), Harold M. Schudt (M), Miss Doris E. Weir (J).

Muskegon Club: Taylor Milton Snyder (M).

New England Section: Charles W. Hodgdon (J), Fook-Chu Li (J), Robert Oscar Miller (J), Sgt. John J. O'Donnell (A).

Northern California Section: Capt. Jack C. Boggess (A), Capt. Orrin T. Fox (A), Capt. Ernest F. Higgins (A), John Hirschfelder (M), George D. Shambrook (A), George A. Thale (A).

Northwest Section: Henry C. Craig (A), James L. Palotay (J), Charles-Robert Pearson (J), Walter F. Sanders (A).

Peoria Group: Robert H. Bonney (J), Paul E. Haiss (M), John F. Millan (J), Fred H. Norris (J), Daniel B. Shotwell (J).

Philadelphia Section: Arthur W. Benham, Jr. (J), Oliver Leonard Brandes (M), George F. Briner (J), Millard Fillmore Foist (A), George Frey (A), Haskell R. Gordon (SM), Charles R. Horner (A), Joseph A. Lawler (A), Marshall C. Smith (M), Morgan Garsed Smith (J), Joseph T. Tweedale (M).

Pittsburgh Section: Harry P. Bean (J).

St. Louis Section: T. A. Haller (M).

Southern California Section: W. B. Allingham (A), Albert G. Blair (A), Arthur L. Bobrick (A), M. J. Breitenbach (J), James T. Crabtree (M), John Wesley Cresse (J), Robert L. Dennis (J), William H. Dillow (A), Charles H. Dodge (J), Lawrence F. Drake (A), Clarence L. Foushee, Jr. (J), Robert P. Geddes, Jr. (A), H. C. Harbers (M), Frank J. Hedrick (A), Lewis W. Imm (M), H. O. Juckeland (A), Frank W. Livermont (A), George True Lundy (A), Myron M. Martin (J), Kenneth L. Miles (M), James A. Moore (J), A. S. Mullgardt (M), Wilbur T. Perry (J), Frank Keys Rein (J), Homer Davis Roe (J), Edward S. Stavneak (A), Paul Wilcox Tracy (J), Howard M. Ulberg (J), Ernest von Seggern (M), Thomas Wolfe (M).

Southern New England Section: Capt. Francis C. Chandler (A), Howard H. Dietrich (M), John Krasnitsky (J), Charles H. Zimmerman (M).

Southern Ohio Section: Wallace Blanchard, Jr. (J), Howard Carson (J), Theodore Robert Dinsmore (M), Lt. Wesley E. Johnson (J), Edwin E. Keiper (A), Robert George Lommel (J), Thomas W. Prosser (A), Karl Schrick, Jr. (J), William Edward Thornley (J).

Texas Section: Henry Thomas Archibald (A), Lt.-Col. Leland A. Burbank (SM), Fayette William Estill (A), Samuel C. Hoot (A), Millard R. Hudnall (M), Ross A. Peterson (M), LeRoy Yates Pond (A), Harry H. Whelan (A).

Washington Section: Edward R. Bartoo (J), John Joseph Donovan (A), Fred H. Fielding (A), John E. Graham (A), Major Edward J. Hobbs (FM), Capt. Warren C. Landis (SM), J. W. Muller (A).

Wichita Section: George W. Baughman (J), Virgil W. Hackett (J), Dwane L. Wallace (M).

Outside of Section Territory: Hans J. Anderson (M), Ambrose L. Chabot (M), Capt. Jack J. Crane (SM), H. Edwin Fultz (J), John W. Hospers (J), Major Ellery E. Kelley (SM), Edwin N. Laurance (M), Eugene Garland Lentz (J), James T. MacKenzie (M), Orville S. Peet (A), Hilbert S. Rader (J), A. J. Raitch (M), Joseph G. Rose, III (J), William C. Thornton (A).

Foreign: Benjamin George Bowden (FM), (England).

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About SAE Members

continued from page 31

SAE members who participated in the program of the 14th Annual Convention of the Greater New York Safety Council included **H. H. KELLY,** director, ODT's Division of Material & Equipment Requirements; **JAMES G. HAYDEN,** director of conservation, Associated Transport, Inc., and **CHARLES G. MORGAN, JR.,** American Trucking Association, Inc., all of whom discussed "New Problems Faced by Motor Transport." Mr. Kelly was chairman of the Commercial Vehicle (No. 2) session. **HAROLD F. HAMMOND,** National Conservation Bureau, was chairman of the session on "Getting War Workers to and from the Job." **JEROME LEDERER** was chairman of the Aviation Operation, at which **R. P. RUSSELL,** Northwest Airlines, Inc., spoke on "Safety for Women in Airline Maintenance and Overhaul."

JOHN D. HOWE is consulting engineer and manager of the Howe Engineering Co. and the Industrial X-ray Co., Indianapolis, Ind. Mr. Howe was formerly product engineer, Allison Division of General Motors Corp., of the same city.

ALFRED CREEK is an aviation cadet in aircraft maintenance engineering at the Army Training Center at Yale. Before entering military service he was a field service trainee for Allison Division of General Motors.

Formerly in the Industrial Engineering Department of Canadian Vickers, Ltd., Montreal, **ROBERT V. WHEELER** is now in the Manufacturing Research Section, Methods and Controls Department of Consolidated Aircraft Corp., Fort Worth, Tex., as industrial engineer.

COL. ROBERT O. MONTGOMERY, formerly executive, U. S. Army, Headquarters 104th Infantry Division, Artillery, Camp Adair, Oregon, is now on the Field Artillery Board, at Fort Bragg, N. C.

Former SAE student members who are now engaged in war production are: **E. C. McCLAUD, JR.,** formerly a student at Massachusetts Institute of Technology, Cambridge, now in graduate engineer training, Pratt & Whitney Aircraft, East Hartford, Conn.; **MYRVEL A. SORENSON,** Iowa State College, now in field service, Pullman Tank Plant, General Motors Diesel Engine Division, Detroit; **IRVING M. KARP,** Cooper Union, and **JOHN REESE ESTERLY,** Ohio State University, now with the National Advisory Committee for Aeronautics, Engine Research Laboratory, Cleveland, as junior mechanical engineers; **LEONARD T. SLADEK,** University of Wisconsin, now with Douglas Aircraft Co., Inc., El Segundo, Calif.; **R. P. WATSON,** A & M College of Texas, with Wright Aeronautical Corp., Paterson, as junior field representative; **WAYNE HENRY JENS,** University of Wisconsin, junior engineer with North American Aviation, Inglewood, Calif.; **CHARLES W. FINKL,** Illinois Institute of Technology, now a draftsman, layout man and detailer, York Aircraft, Kenosha, Wis.; **JOHN V. GAVIC,** University of Wisconsin, junior engineer with North American Aviation, Inglewood, Calif.; **GEORGE J. SCHMIDT,** University of Wisconsin, Madison, junior engineer, Douglas Aircraft Co., Inc., El Segundo, Calif. **YET LIN YEE,** Massachusetts Institute of Technology, Cambridge, now with Douglas Aircraft Co., Inc., Santa Monica, Calif., as engineer.

Formerly an engineer at Thompson Products, Inc., Cleveland, **THOMAS P. DALLOW** is now in the U. S. Army.

2ND LT. J. EDWARD SCHIPPER, JR., has been transferred from Camp Sutton, N. C., to Company R, 303rd Ordnance Regiment, Pedricktown, N. J.

ENSIGN ASA SHIVERICK, JR., USNR, left Thompson Products, Inc., Cleveland, several months ago, to accept a commission in the Navy. He has been assigned to the Navy Department, Bureau of Aeronautics, Washington. Ensign Shiverick had been fuel pump products manager at Thompson.

Formerly assistant chief engineer, **HAROLD E. KOESTER** has been promoted to chief engineer, Righter Mfg. Co., Burbank, Calif.

ENSIGN MICHAEL W. LARINOFF, USNR, is on special duty in the field of diesel engineering. He had been maintenance engineer at the Continental Aviation & Engineering Corp., Detroit.

ERIE "L-7" SUPPRESSORS

Eliminate Ignition Radio Interference

Universal Application
One Style for Both
SPARK PLUGS and DISTRIBUTORS

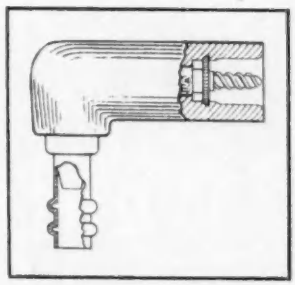
TO eliminate ignition noise in radio receivers, the U. S. Signal Corps' specifications require suppressors on both spark plugs and distributors on many types of gasoline driven military equipment.

The Erie Type L-7 Suppressor is a "Universal Suppressor" inasmuch as it fits standard spark plugs and distributors.

The two rings extending around the metal terminal of Type L-7 Suppressor make pressure contact with the metal insert in the distributor cap, forming a firm electrical connection. Snap-pressure contact with the spark plug and wood screw connection to the cable are vibration proof.

The Type L-7 Erie Suppressor has been approved by the U S. Signal Corps, and its adoption as "standard equipment" will simplify purchasing and make your stocking problem much easier.

Data sheet covering electrical characteristics and other details will gladly be sent upon request.



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T. F. **BRACKETT** has moved from the St. Louis, Mo., office of the Emerson Electric Mfg. Co., to the Detroit office.

LINWOOD F. MILLEN, who had been liaison engineer, Bell Aircraft Co., Buffalo, has joined the General Fireproofing Co., Youngstown, Ohio, as liaison engineer for aircraft production.

GEORGE V. ALEVIZON is a junior field engineer with Ranger Aircraft Engines, Division of Fairchild Engine & Airplane Corp., Farmingdale, L.I., N.Y. Mr. Alevizon was formerly draftsman with the Bell Aircraft Corp., Buffalo, N.Y.

American Bosch Corp.'s training director is now **WILLIAM F. MAGUIRE,** who had been with the Springfield Machine & Foundry Co., Inc., subsidiary of Harrisburg Machinery Corp., Philadelphia.

WILLIAM H. KILDOW, JR. is assistant general manager of Norman E. Miller & Associates, consulting engineers, Detroit. Before joining this company, Mr. Kildow was technical representative for the Shell Oil Co., Inc., New York City.

Formerly line inspector, Hartwell Mfg. Co., Los Angeles, **EVERETT S. ALLEN** is now associated with the California Institute of Technology, Pasadena, as chief inside inspector.

R. D. SPEAS is assistant to the vice-president of engineering, American Airlines, Inc., La Guardia Airport, Jackson Heights, L. I., N. Y. He was formerly research engineer.

JACK T. GRAY is now special assistant to the contract officer, Lockheed Aircraft Corp., Burbank, Calif. Mr. Gray was formerly with the Aeronautical Chamber of Commerce of America, Inc., Washington, as manager of the technical department.

FRANK W. SMITH has severed his connections with the New York City office of Cities Service Oil Co. of Pa., where he was in the Lubrication Department, to join the D. A. Stuart Oil Co., Boston, Mass.

CHARLES E. NEUMANN is a service engineer at Eclipse Aviation, Division of Bendix Aviation Corp., Bendix, N.J.

E. M. LUNDA has been appointed a lieutenant commander, USNR, in the Navy Transportation Branch, Washington, and is chief of the Automotive Maintenance Section. Lt.-Com. Lunda was formerly chief of maintenance of passenger vehicles, U. S. Navy, Transportation Branch, Washington.

ENSIGN H. S. GERSTUNG, USNR, has been transferred from Fort Schuyler, Bronx, N. Y., to the U. S. Naval Engineering Experiment Station at Annapolis, Md.

Formerly officer candidate, U. S. Army, Company 5, Ordnance Officer Candidate School, Aberdeen Proving Ground, Md., **FRED B. HUNT** is now a second lieutenant, and is stationed at the Tank-Automotive Center in Detroit.

J. J. WALLACE, who had been assistant chief engineer, Bristol Aircraft Division, Universal Moulded Products Corp., Bristol, Va., is now with General Aircraft Corp., Astoria, L. I., N. Y., as acting assistant chief engineer.

SAE student members engaged in essential war work include: **ERNST JUSTUS BODENSIECK,** formerly Iowa State University, now in the experimental engineering department of Thompson Products, Inc., Cleveland; **RALPH H. LONG, JR.,** formerly Tufts College, now junior engineer with Curtiss-Wright Corp., Columbus, Ohio; **JAMES F. HOEY, JR.,** Massachusetts Institute of Technology, now junior engineer with Wright Aeronautical Corp., Paterson, N. J.; **WARREN W. LEFFMAN,** formerly University of California, now student engineer at Allis-Chalmers Mfg. Co., West Allis, Wis.; **HOWARD C. DAVIS,** graduate of Ohio State University, Columbus, Ohio, now a student engineer at General Motors Corp., Detroit Diesel Engine Division; **HAROLD MARVIN HIRSCH,** on leave of absence from the California Institute of Technology, now working as junior engineer in aerodynamics, General Motors Corp., Detroit; **DONALD P. WILKINSON,** on leave of absence from California Institute of Technology, now junior engineer in aerodynamics, General Motors Corp., Detroit; **DEAN M. LEWIS,** formerly Iowa State, now junior engineer, Curtiss-Wright Corp., Airplane Division, Louisville, Ky.; **GEORGE F. SODERLING,** formerly Purdue University, now laboratory technician at the Dodge Chicago Plant; **RICHARD H. HUNGER,** formerly Oregon State College, now engineering trainee, Caterpillar Tractor Co., Peoria, Ill.; **J. C. STANSBURY,** graduate of University of Oklahoma, now with the Humble Oil and Refining Co., Baytown,

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Tex.; **ELIZABETH T. IZANT,** graduate of Ohio State University, now junior mechanical engineer with the National Advisory Committee for Aeronautics, Aircraft Engine Research Laboratory, Cleveland; **EDWARD E. ERNST,** formerly Massachusetts Institute of Technology, now with Grumman Aircraft Engineering Corp., New York; **RINALDO BRUN,** formerly Yale University, now with the National Advisory Committee for Aeronautics, Aircraft Engine Research Laboratory, Cleveland.

BENHAM S. POND, formerly assistant chief engineer, Acrotorque Co., Stamford, Conn., is now with the Dowty Equipment Corp., Special Development Division, of the same city. He is director of the division.

For the past several months **W. R. ANGELL, JR.,** has been operating as a consulting engineer in aircraft production, with particular reference to developments in wooden structures. Mr. Angell was formerly vice-president and director of the Morrow Aircraft Corp., San Bernardino, Calif.

HUGH G. BOWLES has joined the Allison Division of the General Motors Corp., Indianapolis, Ind., as junior engineer. He had held a similar position with the Bendix Products Division, General Motors Corp., of the same city.

The appointment of **ROBERT R. ZISETTE** as general sales manager of SKF Industries, Inc., Philadelphia, has been announced by the company. He joined SKF in 1921. After one year in the engineering and sales departments he became sales engineer in the Cleveland office. He remained in this position for seven years, then was promoted to district manager of the Cincinnati office. Last year Mr. Zisette was promoted again, this time to the office of assistant sales manager.

Former chief, Industrial Engine Section, Automotive Division, War Production Board, **GEORGE H. CHERRY** has resigned to rejoin the American Bosch Corp. **FREDERIC R. SPEED, C. L. CUMMINS,** president, Cummins Engine Co., Columbus, Ind., and **ENOS R. JACOBY,** technical director of engineering, Continental Motors Corp., remain. All served with Mr. Cherry.

"The Manly Engine"

A SPECIAL committee under the chairmanship of Neil MacCoull, appointed by the SAE Council, has completed the editing and publication of "The Manly Engine" – a booklet commemorating important contributions of the late Charles M. Manly in the early days of aircraft-engine development. Mr. Manly was president of the Society in 1919.

This booklet reprints from one of the publications of the Smithsonian Institution,* now out of print, a fairly complete account of the inspiring pioneer work done by our past president, Charles M. Manly, in developing an airplane engine which may be considered the ancestor of all modern radial engines. The great number of young engineers who have recently entered the aviation field will find it inspiring to read in Mr. Manly's own words the almost insurmountable difficulties he experienced less than 50 years ago, in securing even the materials to build his engine. He had to import alloy steel from France to make his own ball bearings, high tension cable, and even his own spark plugs. In fact, Mr. Manly only consented to build this engine after it had been found that engine builders in America could not build the desired 12 hp engine, weighing under 8 lb per hp, and the great European engine builders such as Daimler, said an engine of this type was an impossibility.

In spite of such discouraging advice and many other difficulties, unbelievable in our day, Mr. Manly succeeded in building an engine which developed 52.4 average hp for 10 hr, and weighed less than 3 lb per hp. This performance was not exceeded until the advent of the Liberty engine, 17 years later.

This was the first engine in which such innovations were incorporated as a high tension distributor, master-connecting rod, etc.

This engine is of particular interest today because it was financed with government money, as a part of a program of the War Department to develop an airplane for military purposes. President McKinley was farsighted enough to secure a grant of $50,000 from Congress to develop a complete airplane and engine!

It is the expressed desire of the special committee responsible for publication, that this booklet should eventually be available in every library and institution where those interested in aviation and internal combustion engines may have access to it. A particular point has been made to include only the most interesting material, thus resulting in a booklet of only 56 reading pages, so that any busy engineer or student will be able to find time to read it.

Copies of the book, nicely bound in cloth, may be obtained by writing to SAE Headquarters. Price $1.50 per copy.

* From "The Langley Memoir on Mechanical Flight," 1911.

OBITUARIES

J. H. McDuffee

J. H. McDuffee, a pioneer in the automobile industry, died May 12 at the age of 64. Mr. McDuffee was vice-president of the Electric Auto-Lite Co., president of the Prest-O-Lite Battery Corp., American Leather Products Corp. and Prest-O-Lite Storage Battery, Ltd. Prior to joining the Prest-O-Lite organization, he had been a vice-president of Willys-Overland.

Entering the automobile industry with the Stanley brothers of Newton, Mass., in 1898, he became champion speed driver two years later in winning the first three races on a circular track at the opening meeting of the Flower City Gentlemen's Driving Association in Rochester. That same year he won a cup put up by William K. Vanderbilt, Jr. Other pioneering performances which have been credited to Mr. McDuffee include that of being the first man to offer airplanes for sale; receiving the first shipment of Ford cars ever built; operating the first automobile retail store in the country, and holding the first automobile license issued in New York City.

He was the first vice-chairman of the Indiana Section, 1935-36, and was Indiana Section's representative on the Sections Committee in 1936. He joined the Society in 1925.

Norman Bell

Norman Bell, retired mining engineer and general manager of the Norma-Hoffmann Bearings Co. and Precision Bearings, Inc., died April 28. Mr. Bell had been a member of the SAE since 1913.

Stephen B. Tompkins

Stephen B. Tompkins, branch manager of the Autocar Co. of Chicago for many years, passed away suddenly from a heart attack on April 14. He was 52 years old. A member of the SAE since 1924, he had served on a number of committees and was vice-chairman of the Transportation and Maintenance and Truck, Bus and Railcar Activities in the season of 1939-40. He had been with the Autocar Co. since 1931. Between the years 1923 and 1931 Mr. Tompkins was with the Mack Co. in Chicago.

SAE

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Norman G. S

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C. B. Whitte

E. L. Carr

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A. J. Underw

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